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Newfoundland East and Southeast Coast Herring – An Assessment of Stocks to the Spring of 2002

Hareng des côtes est et sud-est de Terre-Neuve – Évaluation des stocks jusqu'au printemps 2002

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ABSTRACT

Results of data analysis from 2000 to the spring of 2002 are presented for four herring stocks along the east and southeast coasts of Newfoundland. Commercial landings in 2000 (3500 t) and 2001 (2300 t) continued to be low due to poor market conditions and price. Spring spawners dominated the catches; however, there was no dominant year class common to all areas. Three series of abundance indices were available for each of the stock areas including research gill net catch rates and acoustic survey biomass estimates extending back to the early 1980's, and commercial gill net catch rates commencing in 1996. Gill net and purse seine fisher observations were also available since 1996. The methodology to describe stock status differed from recent assessments. For each area, current status and future prospects were summarized in a performance report based upon interpretation of abundance indices, biological characteristics, and ecological considerations. For White Bay – Notre Dame Bay, stock status has not changed since the last assessment in 2000 and continues to be poor. The Bonavista Bay – Trinity Bay stock status is also poor; this represents a decline since the 2000 assessment. The status of the St. Mary's Bay – Placentia Bay and Fortune Bay stocks remain unchanged from 2000 and continue to be moderate to good.

RÉSUMÉ

Les résultats de l'analyse des données pour quatres stocks de hareng des côtes est et sud-est de Terre-Neuve de 2000 au printemps 2002 sont présentés dans ce document. Les débarquements commerciaux en 2000 (3500 t) et en 2001 (2300 t) sont demeurés peu élevés en raison de mauvaises conditions de marché et de faibles prix. Les prises étaient dominées par les géniteurs printaniers, mais il n'y avait aucune classe d'âge dominante commune à toutes les zones. Pour chaque zone de stock, trois séries d'indices d'abondance étaient disponibles, soit les taux de capture scientifique au filet maillant et les biomasses estimées par relevé acoustique, séries qui remontent toutes deux au début des années 1980, ainsi que les taux de capture commerciale au filet maillant (depuis 1996). Des observations faites par les pêcheurs au filet maillant et à la senne étaient aussi disponibles depuis 1996. La méthode utilisée pour décrire l'état des stocks diffère des évaluations récentes. L'état actuel et les perspectives des stocks dans chaque zone ont été résumés dans un rapport de performance selon l'interprétation des indices d'abondance, des caractéristiques biologiques et des considérations écologiques. L'état du stock des baies White et Notre Dame est toujours mauvais, comme au moment de la dernière évaluation en 2000. L'état du stock des baies Bonavista et Trinity est également mauvais, ayant empiré depuis l'évaluation de 2000. L'état du stock des baies St. Mary's et Placentia et de celui de la baie Fortune reste modéré à bon, comme en 2000.

INTRODUCTION

There are five herring stocks distributed along the east and southeast coasts of Newfoundland (Figure 1): White Bay - Notre Dame Bay (WB-NDB), Bonavista Bay - Trinity Bay (BB-TB), Conception Bay - Southern Shore (CB-SS), St. Mary's Bay - Placentia Bay (SMB-PB), and Fortune Bay (FB). This document provides an assessment of four of these stocks to the spring of 2002; CB-SS was excluded from the analysis due to the limited commercial fishery and lack of scientific data.

In recent years, east and southeast Newfoundland herring stocks have been assessed bi-annually; the previous most recent assessment was conducted in the fall of 2000 (Wheeler et al. 2001). Although the data sources in the current assessment are similar to those in 2000, the assessment methodology differs considerably.

This document is divided into several sections, outlining the steps taken to assess these herring stocks in 2002. The first section examines the commercial fishery data and the associated biological sampling used to calculate the 2000 and 2001 commercial catches at age. The next section examines the abundance indices for each of the stocks. This section is sub-divided as several series of abundance indices were available, including research gill net catch rates and acoustic survey biomass estimates extending back to the early 1980's, commercial gill net catch rates commencing in 1996, and gill net and purse seine fisher observations, also available since 1996. The third section examines biological and ecological data and their effects on stock status. The document concludes with performance reports on the current status and future prospects of each stock.

Section 1.0 - Description of the 2000 and 2001 Commercial Fisheries and Catches at Age

1.1 Biological Sampling

Biological samples are collected each year from the east and southeast Newfoundland commercial herring fisheries. These data provide information on the age distribution of commercial landings.

Policy and Economics Branch provide commercial catch data (t), by bay, month and gear type. Data for recent years are considered preliminary, as catch statistics have not been finalized for these years. Commercial catch statistics since 1996 are not inclusive, as they do not include catches used for bait purposes.

1.2 The 2000 Fishery

Fisheries Management Branch formulated a two year (1999 and 2000) management plan for east and southeast Newfoundland herring based upon the 1998 SSR released by Science Branch after the 1998 herring stock assessment meetings (Wheeler et al. 1999).

As defined by the stock status classification system, the 2000 plan allowed for a restricted fishery in WB-NDB and a commercial fishery in BB-TB, SMB-PB and FB. A restricted fishery was established in WB-NDB as the status of this stock was considered *poor to moderate* and a fishing mortality of 5% to 10% was recommended. The status of BB-TB and SMB-PB was considered to be *moderate to good* with recommended fishing mortalities of 10% to 20%. FB was considered to be *good to very good* with a recommended fishing mortality of 20%.

The TAC's for the 2000 fisheries were the same as in 1999 for all areas except WB-NDB where they were reduced (Table 1). Quotas were not taken in any of the stock areas and 2000 landings (3500 t) were similar to those in 1999 (3300 t) (Tables 2 - 5 and Figure 2).

The level of biological sampling was more than adequate as 1490 herring were sampled from the 2000 fisheries (Table 6).

Spring spawners accounted for greater than 74% of the catch in all areas; no single year class dominated (Tables 8 - 10 and Figure 3). In WB-NDB, the 1995 year class of spring spawners dominated, followed by the 1994 year class. This was similar to the 1999 fishery. In BB-TB, a broad range of year classes was represented in the 2000 fishery. This differed from 1999 when the 1991 year class dominated. In SMB-PB, the 1996 year class of spring spawners dominated, followed by fish aged 11+. This differed from 1999, when the 1991 year class was dominant in the fishery. In FB, spring spawners of the 1992 year class dominated, as was the case in 1999.

Mean weights at age (Table 11 and Figure 4) in WB-NDB and BB-TB showed an increasing trend for most ages from 1999 to 2000 but were still less than during the 1980's. Mean weights at age for older fish in SMB-PB and FB continued to decrease from 1999 to 2000. However, there was evidence of increased growth for some younger ages.

1.3 The 2001 Fishery

Prior to the 2001 fishery, Fisheries Management Branch formulated a new two year (2001 and 2002) integrated management plan for east and southeast Newfoundland herring. This was based upon the 2000 SSR released by Science Branch after the 2000 herring stock assessment meetings (Wheeler et al. 2001). As defined by the stock status classification system, the plan allowed for a scientific fishery in WB-NDB and commercial fisheries in BB-TB, SMB-PB and FB. A scientific fishery was established for the northern area as the status of this stock was considered *very poor* and a fishing mortalities of less than 5% was recommended. The status of BB-TB was considered to be *good* with a recommended fishing mortality of 20%. The status of SMB-PB and FB was considered to be *moderate to good*; fishing mortalities of 10% to 20% were recommended.

TAC's decreased from 2000 to 2001 in WB-NDB and FB, increased in BB-TB, and remained the same in SMB-PB (Table 1). Quotas were not taken in any of the stock areas and 2001 landings (2300 t) were lower than in 2000 (3500 t) (Tables 2 - 5 and Figure 2).

The level of biological sampling was again more than adequate in 2001 as 838 herring were sampled from the fisheries (Table 12).

Spring spawners accounted for greater than 88% of the catch in WB-NDB and FB; in BB-TB and SMB-PB, spring spawners accounted for 53% and 63% of the respective catch. As in 2000, there was no dominant year class in all areas. In WB-NDB, the 1999 year class replaced the 1995 year class in dominance. In BB-TB, as in 2000, there was a broad range of year classes in the commercial catch. In SMB-PB, the distribution was similar to 2000, dominated by the 1996 year class and fish aged 11+. In FB, the 1996 year class replaced the 1992 year class in dominance.

Mean weights at age exhibited similar trends to 2000 (Table 11 and Figure 4).

Section 2.0 - Abundance Indices

2.1 Research Gill Net Program

The research gill net program was initiated in 1982 to provide age disaggregated abundance indices independent of the commercial fishery. There is a fifteen year time series for WB-NDB an BB-TB, and a twenty-one year time series for SMB-PB and FB. Each year, commercial fishers are contracted to provide catch rate data and biological samples of their catch. In 2002, twenty-nine fishers participated in the program (Figure 5), nine in WB-NDB, ten in BB-TB, six in SMB-PB and four in FB. This represented an increase of six fishers from 2001.

Age distributions of herring (by number) from the research gill net program were available up to and including 2001; biological samples from the 2002 program were not processed in time for this assessment. In all areas, spring spawners accounted for greater than 82% of the catch in 2001. As in the commercial fishery, no single year class dominated (Figure 6), and with minor differences, the age distribution of the catch was similar in 2000 and 2001. In WB-NDB, and BB-TB the 1995 year class was dominant; in SMB-PB and FB, the 1996 year class was dominant. The 1994 year class, which accounted for 30% to 40% of the 2000 catch in WB-NDB and BB-TB, accounted for less than 20% of the 2001 catch in each area.

Year classes are normally recruited to the research gill nets by age three or four years (Wheeler et al. 1997). There was substantial recruitment of the 1997 year class as 4 year olds in 2001 in WB-NDB, where it accounted for 35% of the catch. Similarly, there was recruitment of the 1997 and 1998 year classes in BB-TB where each accounted for approximately 10% of the 2001 catch. There was no evidence of recruitment of year classes since that of 1996 in SMB-PB and FB.

Catch rates at age for spring spawning herring only from the research gill net program are presented by stock area in Table 13 and Figure 7. Catch rates only are available for 2002, as these biological samples have not yet been processed. Catch rates and age distributions by bay are presented in Figures 8 - 10.

Catch rates for WB-NDB have continued to decline since last examined in 2000 (Figure 7). This decline has been continuous since 1992; catch rates in 2002 were the lowest in the time series and were 4% of the peak in 1992. When examined by bay (Figure 8), catch rates have declined in both WB and NDB.

Catch rates for BB-TB have also continued to decline since last examined in 2000 (Figure 7). Catch rates in 2002 were the lowest in the time series and were 8% of the peak in 1997. In recent years, there have been different trends in each bay (Figure 9). From 2000 to 2002, catch rates increased marginally in BB; during the same period, catch rates decreased in TB.

Catch rates for SMB-PB increased from 2000 to 2002 and are currently the highest in the time series (Figure 7). Although trends differed between bays from 2000 to 2001, 2002 catch rates were high in both bays (Figure 10).

There has been a declining trend in FB catch rates since 1998 (Figure 7). However, catch rates are still higher than in any other area and are supported by a broad range of ages including substantial numbers of fish age 11+ years.

Estimates of relative year class size were derived from research gill net catches at age 4 (Figure 11). In WB-NDB and BB-TB, all year classes through the 1990's (to 1997) were considered to be small. In SMB-PB and FB, the 1996 year class was estimated to be less than half that of the 1982 year class, which, in previous assessments (Wheeler et al. 2001), was estimated to be moderate strength.

2.2 Acoustic Survey Biomass Estimates

Acoustic surveys were conducted from 1983 to 2001 to assess Atlantic herring stocks within the Newfoundland Region. Biomass estimates, distribution and behavioral information are available from two surveys since the last assessment, one conducted in WB-NDB in the fall of 2000, and one conducted in FB during the winter of 2001.

The design of the acoustic surveys remained unchanged from recent surveys (Wheeler et al. 2001) and followed that described by Anderson et al. (1998).

The 2000 fall WB-NDB survey was conducted from the *Valerie Amanda II*, a chartered commercial purse-seining vessel. The survey commenced in Great Harbour Deep, White Bay on November 6, 2000 and terminated at Fogo Island, Notre Dame Bay on December 7, 2000. The total length of transects surveyed was 482 n.mi. The survey

averaged 17.3 n.mi. of transects per twelve hour day and all strata were surveyed. During the survey, there was 25% downtime, including one lay day, and two days due to storms.

The 2001 winter FB survey was conducted from the *Three T's 1*, a chartered commercial purse seining vessel. The survey commenced at Pass Island on March 14, 2001 and terminated at Fortune on April 5, 2001. The total length of transects surveyed was 373 n.mi. The survey averaged 23.1 n.mi. of transects per twelve hour day and all strata were surveyed. During the survey, there was 16% downtime, including two days due to storms.

A *Femto* Model 9001 acoustic data acquisition system was used in both surveys in conjunction with a *BioSonics* Model 105 echo sounder and 120 kHz transducer (operating in single beam mode). The transducer, mounted in a v-fin, was deployed at a depth of approximately 3 m astern and abeam of the vessel.

The acoustic system was calibrated in April 2000 and June 2001 . The calibration parameters were as follows:

Parameters	Apr. 2000 (1)	Apr. 2000 (2)	June 2001
Source Level / Receive Sensitivity:	42.23 dB	43.98 dB	43.05 dB
Fixed Receiver Gain:	10.828 dB	10.828 dB	10.914 dB
TVG Gain:	20 log R	20 log R	20 log R
Attenuation Coefficient:	0.0347 dB/m	0.0347 dB/m	0.0347 dB/m
Pulse Length:	0.4 ms	0.4 ms	0.4 ms
Average Beam Factor:	-28.35 dB	-28.04 dB	-28.04 dB

The April 2000 (1) calibration parameters were used for the WB-NDB survey until November 25th at which time the 120 kHz transducer failed. The transducer was replaced and the April 2000 (2) parameters were then applied for the remainder of the survey. The June 2001 calibration parameters were used for the FB survey.

During the surveys, a detailed log record was maintained for each transect and also while steaming between transects. Observations were recorded of all fish concentrations (pelagic and groundfish) detected on both the echogram and oscilloscope.

The acoustic data, as recorded in the detailed log, were edited subsequent to the surveys, using a *Femto* acoustic data editing system. All bottom signals were removed and only those fish concentrations considered being herring (from visual inspection of oscilloscope and echogram images) were included in the analyses.

Where concentrations warranted, and depth and weather conditions permitted, biological samples of herring were collected during the surveys using a purse seine.

Acoustic back-scatter was converted to herring density using the following target strength - fish length relationship calculated for herring by Wheeler et al. (1994):

$$T.S. = 20 \log L - 65.5$$

Mean fish lengths were derived from biological samples collected during the survey. Target strength per fish was converted to target strength per unit fish weight using mean fish weights from the biological samples. Age distributions were also calculated from the samples.

Formulas used to calculate mean densities, variances, and biomass estimates remained unchanged from previous surveys and are described in Wheeler (1991).

For the purpose of plotting herring distributions, mean densities (g/m^2) were calculated per 10 sec. (~30 m) intervals along each transect for the surveys.

2.2.1 White Bay - Notre Dame Bay

During this survey, 292 transects were surveyed (Figure 12). Herring were acoustically detected in 7 of the 21 strata surveyed. Concentrations of herring were detected and integrated near Jackson's Cove, in Southern Arm, in Little Bay Arm, near Little Bay Island, in Badger Bay, and in the Bay of Exploits.

One purse seine set was made during the survey; no herring were caught. However, samples from the commercial fishery were available from two locations (Table 14). As mean lengths and weights from these samples were similar, the samples were combined to calculate one target strength for the entire survey (Table 15).

A biomass estimate of 312 t was derived from the survey area (Table 16), all of which was in Notre Dame Bay and Green Bay (Figure 13).

Spring spawners accounted for 72.0% of the population numbers (Figure 14). The estimate of spring spawners (230 t) represented a substantial decrease from the last acoustic survey of the area in 1998 (Table 17). The 1995 year class accounted for approximately 55% of the population estimate; there was also limited evidence of recruitment of the 1996 and 1997 year classes which each accounted for less than 10% of the population estimate (Figure 14).

2.2.2 Fortune Bay

During this survey, 378 transects were surveyed (Figure 15). Herring were acoustically detected in 2 of the 12 strata surveyed. Concentrations of herring were detected and integrated in Long Harbour and near Harbour Breton.

Herring were sampled by purse seine in one location during the survey (Table 18). Mean lengths and weights from this sample were used to calculate a target strength for the entire survey (Table 19).

A biomass estimate of 3452 t was derived from the survey area (Table 20). Greater than 99% of the estimated biomass was detected in Long Harbour (Figure 16).

Spring spawners accounted for 94% of the population numbers (Figure 17). The estimate of spring spawners (3215 t) represented a substantial decrease from the last acoustic survey of the area (Table 21) and was the second lowest in the time series. The 1996 year class dominated, accounting for approximately 50% of the population estimate (Figure 17).

2.3 Commercial Gill Net Logbook Program

In 1996, Science, Oceans, and Environment Branch started a program to increase the scientific information derived from the fixed gear herring fishery and to allow for the quantitative input of commercial fishers in the assessment process.

The long-term goal of this program is to develop a time series of catch per unit effort (CPUE) data from the commercial fixed gear fishery. These data will complement information derived from the research gill net program that has been used to track herring year class abundance since the early 1980's.

From 1996 to 1999, logbooks, prepared by Science, Oceans, and Environment Branch, were distributed by Fisheries Management Branch to greater than 2000 fishers along the east and southeast coasts of Newfoundland as part of the fisher's fixed gear herring license package. Commencing in 2000, logbooks were mailed directly to approximately 2800 fishers in an effort to ensure that all fixed gear and bait fishers received a logbook.

The logbook, the format of which has been described in Wheeler et al. (1999), was designed to be completed by gill net fishers involved in the spring commercial (food fish) fishery, spring bait (lobster) fishery, and/or fall commercial fishery. Subsequent to the 1998 fishery, the logbook was revised to allow fishers to indicate the number of nights that each net was fished each time that it was hauled.

In 2000, a standardized panel area was calculated for each mesh size net by calculating the mean net panel area by mesh size for data collected from all areas between 1996 and 1999. Catch rates for the entire time series were then standardized to allow for comparisons between areas and years.

Prior to this assessment, historical data from 1981 and 1983 were included for WB-NDB, BB-TB and SMB-PB. These data were derived from logbooks completed by fishers at that time, which have since been coded and incorporated into the current database. In the

original 1981 and 1983 logbooks, fishers recorded the mesh size of nets fished, but did not record the length and depth of nets fished. Consequently, when these data were incorporated in the current database, it was assumed that each net fished had the standardized panel area, as calculated above.

Depending upon the area fished, most logbooks were from winter / spring / early summer fisheries. Logbooks from fall fisheries were limited in number and were not included in the analysis. All logbooks received to September 2002 have been included.

2.3.1 White Bay - Notre Dame Bay

The number of logbook returns increased from 8 in 2000 to 10 in 2001 and then decreased to 6 in 2002 (Table 22 and Figure 18). The age range of fishers remained relatively stable over the same time period. The total number of nets fished decreased from 19 in 2000 to 14 in 2002. Similarly, the number of nights fished also decreased, from 306 in 2000 to 188 in 2002. The mean mesh size of nets fished decreased by 4% from 2000 to 2002. Mean panel area also decreased over the period and was 15% smaller in 2002 than in 2000. The spatial distribution of fishing effort represented by the logbooks was similar in all years and was restricted primarily to the eastern portion of Notre Dame Bay (Figure 19). The temporal distribution of fishing effort was also similar over the time period but shoed some contraction in 2002 (Figure 18). Catch rates, which increased from 1998 to 2001, decreased sharply in 2002 and are currently the lowest in the time series (Figure 20). The decline in catch rates was consistent with the observations of fishers who indicated a decline in abundance from below average in 2001 to well below average in 2002 (Figure 20). Fishers also indicated that spawning intensity has been below average each year since 1998 (Figure 20).

2.3.2 Bonavista Bay - Trinity Bay (BB-TB)

The number of logbook returns increased from 9 in 2000 to 10 in 2001, but decreased to 7 in 2002 (Table 22 and Figure 21). The age range of fishers increased slightly over the same time period. The total number of nets fished decreased from 29 in 2000 to 14 in 2002. The number of nights fished exhibited similar trends. The mean mesh size of nets fished increased marginally (2%) from 2000 to 2002 whereas mean panel area decreased 8% over the same time period. The spatial distribution of fishing effort represented by the logbooks has been widespread and similar in most years (Figure 22). The temporal distribution of fishing effort contracted from 2000 to 2002, commencing later and ending earlier (Figure 21). Catch rates decreased from 2000 to 2002 and are currently the lowest in the time series (Figure 23). The decline in catch rates was consistent with the observations of fishers who indicated a decline in abundance from below average in 2001 to well below average in 2002 (Figure 23). Fishers also indicated that spawning intensity has been below average each year since 1998 (Figure 23).

2.3.3 St. Mary's Bay - Placentia Bay (SMB-PB)

The number of logbook returns increased from 1 in 2000 to 3 in 2001 and 2002 (Table 22 and Figure 24); any conclusions regarding 2000 are limited. The age range of fishers was similar from 2000 to 2002. The total number of nets fished and nights fished increased over the time period. The mean mesh size of nets fished decreased marginally (1.3%) from 2000 to 2002; mean panel area of nets decreased by 21% over the same time period. The spatial distribution of fishing represented by the logbooks was similar in 2001 and 2002 (Figure 25). The temporal distribution of fishing effort was broader in 2002 than in 2000 and 2001 (Figure 25). Catch rates were stable from 2000 to 2001 and increased from 2001 to 2002; current catch rates are the second highest in the time series (Figure 26). Fishers indicated that abundance increased from 2001 to 2002 but was still below average (Figure 26). They also indicated that spawning intensity increased from 2001 to 2002 but was still below average (Figure 26).

2.3.4 Fortune Bay (FB)

The number of logbook returns decreased from 11 in 2000 to 8 in 2001 and to 5 in 2002 (Table 22 and Figure 27). The mean age of fishers increased from 2000 to 2002. The total number of nets fished and nights fished decreased over the time period. The mean mesh size of nets decreased by 4.1% from 2000 to 2002, whereas the mean panel area increased by 10.2% over the same time period. Although the number of logbooks in 2002 was reduced, the spatial distribution of returns was broad and similar to previous years (Figure 25). The temporal distribution of fishing effort was also similar across the time series (Figure 27). Catch rates decreased from 2000 to 2001 but increased again in 2002; current catch rates are the second highest in the time series (Figure 28). This was comparable with the observations of fishers who indicated that abundance had increased slightly from 2001 to 2002 and was still above average (Figure 28). Similarly, they also indicated that spawning intensity increased and was above average (Figure 28).

2.4 Commercial Purse Seine Questionnaire

In 1996, a questionnaire was designed to quantitatively evaluate biological and fishery related information obtained from east and southeast Newfoundland herring purse seine fishers.

Each year, Fisheries Management Branch provides a list of all east and southeast Newfoundland herring purse seine fishers who have participated in the current year fishery. An attempt is made to contact all fishers. To minimize time and costs, the surveys are conducted by telephone.

For the three northern areas, there is a fall purse seine fishery only and survey results are available to 2001. For St. Mary's Bay - Placentia Bay, there is a late winter / early spring fishery and survey results are available to 2002.

In 2000, 15 of 20 fishers (75%) who participated in the fishery (all areas) were contacted. In 2001, 6 of 7 fishers (86%) were contacted, and to date in 2002, all 5 (100%) fishers who participated in the winter / spring purse seine fishery in St. Mary's Bay - Placentia Bay were contacted (Table 23). In all years, a minimum of three attempts was made to contact the remaining fishers.

The number of participants in the WB-NDB and BB-TB purse seine fisheries decreased from 2000 to 2001; in SMB-PB, the number of participants increased from 2000 to 2002. Overall, the numbers of fishers participating in the purse seine fishery decreased by 60% from 2000 to 2001 and the number of participants in 2001 was the lowest in the time series (Table 23).

2.4.1 Questions Regarding Herring Abundance

Three questions were asked to compare herring abundance in one's home bay in current and previous years (Figure 29). Fishers in all areas indicated that herring abundance continued to be above average in 2000. Fishers in BB-TB and SMB-PB indicated that abundance increased from 2000 to 2001. Fishers were also asked to retrospectively estimate abundance in their home bay in the previous year. For all stock areas, the retrospective abundance estimates for 1999 from the 2000 survey and for 2000 from the 2001 survey were variable. However, retrospective estimates tended to be higher. When asked to compare abundance in the most recent year to when they started fishing herring by purse seine (Figure 29), BB-TB fishers indicated that current abundance was the same as when they first started fishing. SMB-PB fishers indicated that current abundance was higher than when they started fishing.

2.4.2 Fleet Characteristics

All respondents were asked a series of questions to characterize the demographics of the population of purse seine fishers; these were designed to monitor changes in fishing experience and fleet capacity.

Responses indicated that the mean age of fishers increased over the time period in all areas, with most now in the age 50 – 60 range (Figure 30). Responses also indicated that participants in the 2001 and 2002 fisheries had substantial experience and had fished, on average, since the early 1980's (Figure 30).

The average fishing vessel length and capacity increased marginally from 2000 to 2001 (Table 24).

2.4.3 Questions on the Fishery

Fishers were asked questions regarding the bays and the months in which they fished (Figure 31). For WB-NDB, in 2000 there was approximately an equal distribution of fishers in WB and NDB; in 2001 there was no purse seine fishery. The 2000 fall fishery commenced earlier than in previous years as fishers pursued mackerel and herring simultaneously. For BB-TB, the 2000 and 2001 fall fisheries occurred entirely in the northern part of BB; the timing of these fisheries was similar to previous years. For SMB-PB, the 2000 fishery occurred entirely within PB. In 2001, it occurred primarily in SMB; in 2002, it switched back and occurred on the eastern side of PB. During this period, the timing of the fishery did not change, occurring primarily in March.

Three questions were asked regarding abundance of herring during the current fishery compared to previous years (Figure 32). When asked to compare the number and size of herring schools detected in the current year fishery with the previous year, respondents in 2000 in all areas indicated that the number of schools either decreased or remained the same. Results regarding size of schools in 2000 was more variable, up in WB-NDB, down in BB-TB, and no change in SMB-PB. In 2001, the number and size of schools was up or the same in all areas. Results were similar for SMB-PB in 2002.

A series of questions was asked to determine the distribution of fishing effort. To facilitate analysis, each stock area was divided into geographical sub-areas or strata (Figure 33). In all areas and years, successful sets continued to be restricted to a few strata within each stock area; successful fishing sets were not widely distributed throughout the stock areas. The percentage of successful sets remained high in all areas. The majority of successful sets also occurred during daylight hours.

The total landings of the purse seine fleet (Table 25) decreased in WB-NDB and BB-TB from 2000 to 2001 but increased in SMB-PB. In most areas and years, total landings matched the commercial landing data. However, in at least three instances (BB-TB 1996, SMB-PB, 1997, and SMB-PB 2000) landings reported from questionnaires were substantially higher than those from commercial landing data (Figure 34). The ratio of removals to landings remained similar in most areas but increased substantially in BB-TB in 2001. This was due to an increase in the level of discarding due to the size of the fish (Figures 35 and 36).

2.4.4 Biological Events

A question was asked to quantify observations regarding the seasonal timing of herring migration in the current year compared to the previous year (Figure 36). For BB-TB, the timing in 2001 was considered the same. For SMB-PB, the timing in 2002 was considered to be earlier.

Section 3.0 – Biological and Ecological Data

3.1 Water Temperatures

It has been shown (Winters and Wheeler 1987) that when good survival of young herring (i.e. recruitment) occurred through the 1960's to 1980's, it was largely influenced by suitable environmental conditions, principally warm over-wintering water temperatures and high salinities prior to spawning. Ocean temperatures and salinities in the early to mid 1990's were below average and year classes produced during this period were weak. Since 1997, ocean temperatures in coastal Newfoundland waters have been warmer and similar to the long-term average (Figure 37); however, salinities have remained low. There has been no evidence of strong recruitment of year classes during this period (Figure 38).

3.2 Length and Age at Maturity

When compared to the early 1980's, in most areas, the age at which herring mature has remained stable (Figures 39 - 42). Most herring are mature by age 6 and can live in excess of 11 years. However, due to reduced growth rates (Figure 4), herring are smaller at age in recent years. Consequently, the length at which fish mature is smaller in most areas (Figures 39 - 42). This affects fecundity, i.e. the number of eggs produced. A 1 cm reduction in the length at which herring mature results in a 12% to 16% reduction in fecundity (Hodder 1972). The impact of a reduction in number of eggs deposited due to lower fecundity is uncertain.

3.3 Predation

Quantitative information on the predation of herring is available only for seals. It has been estimated (Hammill and Stenson 2000) that, in 1996, seals consumed 36000 t of herring in NAFO Divs. 2J3KL, an area encompassing all east and southeast Newfoundland herring stocks, except Fortune Bay. From 1990 to 1996, it was estimated that the consumption of herring by seals in Atlantic Canada increased by 40%. Most of the herring consumed are less than 30 cm in length. The proportion of herring in harp seal diet in the near shore Newfoundland waters has also increased since the 1980's (Figure 43). This has led to increased mortality of herring by harp seals. However, other changes in predation mortality are unknown.

Section 4.0 – Stock Status

4.1 Methodology

The methodology used to describe stock status in this assessment differs substantially from the previous most recent assessment in 2000 (Wheeler et al. 2001). For

each stock area, current stock status and future prospects were summarized in a performance report (Tables 26 - 29). Observations on abundance indices, biological characteristics, and ecological considerations were interpreted and then evaluated using the traffic light method (Caddy 1998). This method uses a system of red (-), yellow (?), and green (+) lights to categorize indicators as 'cause for concern', 'uncertain', or 'positive'. In this assessment, 'uncertain' was defined as 'uncertainty of an interpretation' rather than precautionary uncertainty.

Five series of abundance indices were evaluated for each stock including: research gill net catch rates, acoustic survey biomass estimates, commercial gill net catch rates, gill net fisher observations, purse seine fisher observations, and recruitment estimates. Purse seine fisher observations were not available for Fortune Bay, as there is no purse seine fishery in the area.

Biological characteristics, including age compositions, weights at age, and length and age at maturity were evaluated. Ecological considerations included predation by harp seals, and changes in water temperature and salinity.

In evaluating current stock status and future prospects, only abundance indices and age compositions were considered. Current stock status was described based upon a qualitative evaluation of age composition data (range of mature age groups) and all abundance indices (excluding recruitment data).

Age compositions from research gill nets were considered to best represent population age structure, but age composition data from acoustic surveys and the commercial fishery were also included in the analysis.

Future prospects were described by evaluating the strength of the mature year classes and of recruiting year classes (since 1988). Recruitment data were available from research gill net catch rates at age, from acoustic surveys, and from the commercial fishery.

4.2 White Bay – Notre Dame Bay

4.2.1 The Fishery

Landings decreased from 1093 t in 2000 to 22 t in 2001; 2% of the TAC was taken in 2001 (Table 2). In 2002, the catch (to June 30th) was 17 t. In addition to reported landings, since 1996 an unknown amount of herring (considered to be less than 500 t) is caught annually in the gill net bait fishery.

Effort was less in the 1990's than in the 1980's and has continued to decline. Purse seine effort in the fall fishery as defined by 'sets per fisher' decreased by 88% from 1997 to 2000 (Table 30); there was no purse seine fishery in the fall of 2001. Gillnet effort (net nights fished per fisher) in the spring fishery decreased by 86% from 1996 to 2002 (Table 31).

There was no purse seine fishery in 2001. The 2002 gill net fishery, from early May to mid June, was mostly in eastern Notre Dame Bay (Figure 19).

4.2.2 Abundance Indices

Research gill net catch rates (number of fish per nights fished) have decreased continuously since 1992; catch rates in 2002 were the lowest in the 15 year time series and were 3% of the peak in 1992 (Figure 7). This suggests that current abundance is very low and decreasing.

The biomass (t) estimated from an acoustic survey in the fall of 2000 was the lowest in the time series (Table 17). There has been a decreasing trend in 10 surveys conducted between 1983 and 2000. The 2000 estimate was less than 1% of the peak in 1985. A current evaluation could not be made, as more recent data were not available; however, abundance in 2000 was very low and much lower than in the 1980's.

Commercial gillnet catch rates (kilograms per net per nights fished) have exhibited a decreasing trend in the 7 year time series (Figure 20). There was a large decrease from 2001 to 2002; the 2002 catch rate was the lowest in the series, and was 3% of the peak in 1996. This suggests that current abundance is very low and decreasing.

Gillnet fishers indicated (on a ten point scale) that herring abundance in 2002 was below average and decreasing (Figure 20), also suggesting that current abundance is low and decreasing.

Purse seine fishers indicated (on a ten point scale) that herring abundance in 2000 was above average and stable (Figure 29). There was no purse seine fishery in the fall of 2001. A current evaluation could not be made, as more recent data were not available. However, their observations suggested that abundance in 2000 was stable and no cause for concern.

Most observations indicate poor recruitment of recent year classes. Herring of the 1998 or subsequent year classes were not detected in the 2001 research gillnet program (Figure 6). Samples from 2002 have not yet been processed. Similarly, they were not detected in the 2000 acoustic purse seine survey (Figure 14). No abundance estimates are available; however, this suggests that recent year classes are not strong.

4.2.3 Biological Characteristics

The age composition from the 2001 research gillnet catch was dominated by the 1995 and 1997 year classes with each accounting for approximately 35% of the catch (Figure 6). There were very few younger mature fish and few fish older than age 7. This was consistent with the age distribution from the 2000 acoustic survey (Figure 14). A truncated age composition is considered a cause for concern.

Weights at age have decreased continuously during the 1980's and 1990's and, in 2001, were approximately 9% less than in the early 1990's and 25% less than in the early 1980's (Figure 4). This can potentially lead to an increase in fishing mortality per tonne of fish caught.

Herring are smaller at age than in the early 1980's. The length at which 50% of herring matured in 1982-1984 was approximately 31 cm; this decreased to 29 cm in 1999-2001 and would result in a concurrent reduction in fecundity. The age at which 50% of herring mature remained relatively consistent at 4.5 to 5.0 years (Figure 39). The impact of a reduction in number of eggs deposited due to lower fecundity is uncertain.

4.2.4 Ecological Considerations

The proportion of herring in the diet of harp seals, in inshore areas of NAFO Div. 2J3KL, increased between the late 1980's and the mid 1990's, during a time when the harp seal population increased by approximately 44%, from 3.5 million to 5.2 million seals (Figure 43). It is not clear if this resulted in an increase in consumption of herring from the area due to the high variance associated with diet estimates and changes in sampling over this time period. Although there was increased mortality by harp seals, other changes in predation mortality are unknown, as no other predation information was available for this assessment.

Mean annual water temperatures (at 10 m) in Notre Dame Bay decreased from 5°C in 1990 to 3°C in 1992, but then increased gradually to 6°C in 1999, similar to the long-term average (Figure 37). Lower water temperatures in the 1990's may have lead to reduced herring growth rates. Lower temperatures may also adversely affect recruitment (Winters and Wheeler 1987).

Mean annual salinities (at 10 m) at Station 27 off St. John's decreased between 1990 and 1991 and have remained at levels lower than in the 1980's (Figure 38). Lower salinities may also adversely affect recruitment (Winters and Wheeler 1987).

4.2.5 Current Stock Status

With one exception (purse seine fisher observations in 2000), all abundance indices show that this stock is at a very low level, possibly the lowest since the stock was closed to fishing in the early 1980's (Table 26). Mature year classes in the population are considered to be weak, contributing to this decline. The spawning stock is dominated by two age groups, with very few younger or older mature fish. Mean weights at age have decreased since the 1980's, and this may have resulted in increased fishing mortality per tonne of catch.

During this same period, there has been an increase in the proportion of herring in the diet of harp seals, at a time when the seal population is increasing.

Stock status has not changed since the last assessment in 2000 when it was classified as very poor.

4.2.6 Stock Outlook

There is no evidence of strong recruitment of recent year classes from research gill net catches, the acoustic survey, or the commercial fishery.

The reduction in mean weights at age during the 1990's was coincident with a reduction in fecundity (ie. eggs deposited per female). Given the uncertainty in the relationship between fecundity and egg survival, the impact of this on recruitment is unknown.

Recruitment has been shown to be positively influenced by warm over-wintering temperatures and high salinities during the over-wintering period prior to spawning. Although recent water temperatures have been similar to long term averages, salinities have been below normal. Mature biomass will not increase in the near future.

4.3 Bonavista Bay – Trinity Bay

4.3.1 The Fishery

Landings decreased from 1090 t in 2000 to 486 t in 2001; 14% of the TAC was taken in 2001 (Table 3). In 2002, the catch (to June 30th) was 391 t. In addition to reported landings, an unknown amount of herring (considered to be less than 300 t) is caught annually in the gill net bait fishery. Mortality from discards in the 2001 fall purse seine fishery, due entirely to small fish, was reported to be approximately 350 t (Table 25).

Overall, effort was less in the 1990's than in the 1980's. Gill net effort (net nights fished per fisher) in the spring fishery declined by 79% from 1996 to 2002 (Table 31). However, purse seine effort in the fall fishery (sets per fisher) increased since 1996 and was the highest in 2001 (Table 30).

The 2001 fall purse seine fishery, in October and November, was concentrated in the northern part of Bonavista Bay (Figure 33). The 2002 spring gill net fishery, from mid April to mid June, was distributed throughout Bonavista and Trinity Bays (Figure 22).

4.3.2 Abundance Indices

Research gill net catch rates (number of fish per nights fished) have decreased continuously since 1997; catch rates in 2002 were the lowest in the 15 year time series and

were 8% of the peak in 1997 (Figure 7). This suggests that current abundance is very low and decreasing.

There was a decreasing trend in the biomass (t) estimates from 10 acoustic surveys conducted between 1984 and 1999 (Figure 44). A current evaluation could not be made, as more recent data were not available; however, abundance in 1999 was low and much lower than in the 1980's.

Commercial gill net catch rates (kilograms per standard net per nights fished) exhibited a large decrease from 2001 to 2002 (Figure 23). The 2002 catch rate was the lowest in the 7 year time series, and was 10% of the peak in 1996. This suggests that current abundance is very low and decreasing.

Gill net fishers indicated (on a ten point scale) that herring abundance in 2002 was below average and decreasing (Figure 23), also suggesting that current abundance is low and decreasing.

Purse seine fishers indicated (on a ten point scale) that herring abundance in 2001 was above average and increasing (Figure 29). Their observations suggest that current abundance is increasing and no cause for concern.

There is some evidence of recruitment of recent year classes. Herring from the 1998 year class were caught in the 2001 research gillnet program. Similarly, 1998 and 1999 year class fish were caught in the 2001 commercial fishery. The research gillnet catch rates at age (age 3 only), indicate that the 1998 year class is weak. The size of the 1999 year class has not been quantified but may be considered small since it has not appeared in the research gillnet catches.

4.3.3 Biological Characteristics

The age composition from the 2001 research gillnet catch was dominated by the 1995 year class which accounted for approximately 40% of the catch (Figure 6). Younger mature fish and fish older than age 7 were also well represented in the catch. This was consistent with the age distribution from the 2001 commercial fishery (Figure 3). This is considered to be positive as the spawning biomass consists of a broad age composition.

Weights at age have decreased continuously during the 1980's and 1990's and, in 2001, were approximately 8% less than in the early 1990's and 28% less than in the early 1980's (Figure 4). This can potentially lead to an increase in fishing mortality per tonne of fish caught.

Herring are smaller at age than in the early 1980's. The length at which 50% of herring matured in 1982-1984 was approximately 30 cm; this decreased to 29 cm in 1999-2001 and would result in a concurrent reduction in fecundity. The age at which 50% of

herring mature remained relatively consistent at 4.0 to 4.5 years (Figure 40). The impact of a reduction in number of eggs deposited due to lower fecundity is uncertain.

4.3.4 Ecological Considerations

The proportion of herring in the diet of harp seals, in inshore areas of NAFO Div. 2J3KL, increased between the late 1980's and the mid 1990's, during a time when the harp seal population increased by approximately 44%, from 3.5 million to 5.2 million seals (Figure 43). It is not clear if this resulted in an increase in consumption of herring from the area due to the high variance associated with diet estimates and changes in sampling over this time period. Although there was increased mortality by harp seals, other changes in predation mortality are unknown as no other predation information was available for this assessment.

Mean annual water temperatures (at 10 m) in Bonavista Bay decreased from 5.5°C in 1990 to 3.5°C in 1992, but then gradually increased to 4.5°C in 2000, similar to the long term average (Figure 37). Lower water temperatures in the 1990's may have lead to reduced herring growth rates. Lower temperatures may also adversely affect recruitment (Winters and Wheeler 1987).

Mean annual salinities (at 10 m) at Station 27 off St. John's decreased between 1990 and 1991 and have since remained at levels lower than in the 1980's (Figure 38). Lower salinities may also adversely affect recruitment (Winters and Wheeler 1987).

4.3.5 Current Stock Status

With one exception (purse seine fisher observations in 2001), all abundance indices show that this stock is at a low level, possibly the lowest in 20 years (Table 27). Although the population age structure is considered to be stable, mature year classes in the population are considered to be weak, contributing to this decline. Mean weights at age, reduced during the 1990's compared to the 1980's, may have led to increased fishing mortality per weight of fish caught.

During this period, there has been an increase in the proportion of herring in the diet of harp seals, at a time when the seal population is increasing.

Stock status has declined since the last assessment in 2000 when it was classified as good. Since then, mature year classes in the population have been shown to be weak, and there has been a substantial decrease in commercial and research gillnet catch rates.

4.3.6 Stock Outlook

Recent year classes (1998 and 1999) were found in research gillnet catches, the acoustic survey, and the commercial fishery. The research gillnet data (age 3 only), indicate that the 1998 year class is weak, while the abundance of the 1999 year class has not been quantified.

The reduction in mean weights at age during the 1990's was coincident with a reduction in fecundity (ie. eggs deposited per female). Given the uncertainty in the relationship between fecundity and egg survival, the impact of this on recruitment is unknown.

Recruitment has been shown to be influenced by warm over-wintering temperatures and high salinities during the over-wintering period prior to spawning. Although recent water temperatures have been similar to long term averages, salinities have been below normal.

Any increase in mature biomass in the near future will depend upon the strength of the 1998 and 1999 year classes. As noted above, it appears the 1989 year class is weak.

4.4 St. Mary's Bay – Placentia Bay

4.4.1 The Fishery

Landings in 2000 and 2001 were approximately 500 t; 25% of the TAC was taken in 2001 (Table 4). In 2002, the catch (to June 30th) was 1120 t, over double the catch in all of 2001. In addition to reported landings, since 1996 an unknown amount of herring (considered to be less than 150 t) is caught annually in the gill net bait fishery. There was minimal reported discard mortality in the 2002 winter/spring purse seine fishery (Table 25).

Effort increased from the 1980's to the 1990's. Purse seine effort (sets per fisher) peaked in 1997 and has since declined by 71% (Table 30). Gillnet effort (net nights fished per fisher) peaked in 1998 and has since declined by 89% (Table 31).

The purse seine fishery, in March 2002, was concentrated along the eastern side of Placentia Bay, similar to recent years (Figure 33). The 2002 gillnet fishery, from mid February to early June, was mostly in Placentia Bay (Figure 25).

4.4.2 Abundance Indices

Research gillnet catch rates (number of fish per nights fished) decreased from 1996 to 1998 but have shown an increasing trend since 2000 and are currently the highest in the 21 year time series (Figure 7). This suggests a recent increase in abundance, a positive stock signal.

The biomass (t) estimated from the most recent acoustic survey in the winter of 2000 was the lowest in the time series (Figure 45). There was a decreasing trend in 10 surveys conducted between 1984 and 2000. The 2000 estimate was 5% of the peak in 1984. A current evaluation could not be made, as more recent data were not available; however, abundance in 2000 was low and much lower than in the 1980's.

Commercial gillnet catch rates (kilograms per standard net per nights fished) were stable at a low level from 1999 to 2001. They increased from 2001 to 2002 and the 2002 estimate was the second highest in the 7 year time series (Figure 26). This suggests a recent increase in abundance, a positive stock signal.

Gillnet fishers indicated (on a ten point scale) that herring abundance in 2002 was below average and either stable or increasing marginally (Figure 26). This negative signal suggests that current abundance is low but not decreasing.

Purse seine fishers indicated (on a ten point scale) that herring abundance in 2002 was above average and increasing (Figure 29). Their observations suggest that current abundance is increasing and no cause for concern.

Most observations suggest possible poor recruitment of recent year classes. Herring from the 1998 year class were caught in the 2001 research gillnet program (Figure 6). Fish younger than 3 years of age were not caught in the 2001 commercial fishery, and were not detected in the 2000 acoustic survey (Figure 17). The research gillnet catch rates at age (age 3 only) indicate that the 1998 year class is weak (Table 13).

4.4.3 Biological Characteristics

The age composition from the 2001 research gillnet catch was dominated by the 1996 year class which accounted for approximately 55% of the catch (figure 6). Older fish were not evident in the research gill net catch but were represented in the 2001 commercial fishery (Figure 3). Younger fish were not evident in any of the catches. Although there was a fairly broad population age structure, there is concern regarding the apparent lack of younger fish.

Weights at age have decreased continuously during the 1980's and 1990's and, in 2001, were approximately 19% less than in the early 1990's and 24% less than in the early 1980's (Figure 4). This can potentially lead to an increase in fishing mortality per weight of fish caught.

Herring are smaller at age than in the early 1980's. The length at which 50% of herring matured in 1982-1984 was approximately 30 cm; this decreased to 29 cm in 1999-2001 and would result in a concurrent reduction in fecundity. The age at which 50% of herring mature remained relatively consistent at 4.0 to 4.5 years (Figure 41). The impact of a reduction in number of eggs deposited due to lower fecundity is uncertain.

4.4.4 Ecological Considerations

No predation information was available for this stock.

Mean annual water temperatures (at 10 m) in Placentia Bay decreased rapidly from 6.5°C in 1990 to 5.0°C in 1992, but then increased gradually to 7.0°C in 2000, similar to the long term average (Figure 37). Lower water temperatures in the 1990's may have lead to reduced herring growth rates. Lower temperatures may also adversely affect recruitment (Winters and Wheeler 1987).

Mean annual salinities (at 10 m) at Station 27 off St. John's decreased between 1990 and 1991 and have since remained at levels lower than in the 1980's (Figure 38). Lower salinities may also adversely affect recruitment (Winters and Wheeler 1987).

4.4.5 Current Stock Status

Most data show that this stock is increasing due to the recruitment of the 1996 year class (Table 28). Data from research gill net catch rates at age, indicate that this year class is of moderate strength, at best. Other mature year classes in the population are considered to be weak. Although a single age group dominates the mature population, a wide range of ages is present.

Mean weights at age have decreased since the 1980's, and this may have resulted in increased fishing mortality per tonne of catch.

Although current stock status has been given a positive rating, this should be treated with caution because the mature biomass is largely dependent upon one year class. All other mature year classes are considered to be weak.

The status of this stock has not changed since the last assessment in 2000 when it was classified as moderate to good.

4.4.6 Stock Outlook

The recruiting 1998 year class was present only in the research gillnet catches. Based upon these data it appears to be weak. There is no evidence of the recruitment of subsequent year classes.

The reduction in mean weights at age during the 1990's was coincident with a reduction in fecundity (ie. eggs deposited per female). Given the uncertainty in the relationship between fecundity and egg survival, the impact of this on recruitment is unknown.

Recruitment has been shown to be influenced by warm over-wintering temperatures and high salinities during the over-wintering period prior to spawning. Although recent water temperatures have been similar to long term averages, salinities have been below normal. Any increase in mature biomass, in the near future, will depend upon the strength of the 1998 year class.

4.5 Fortune Bay

4.5.1 The Fishery

Landings increased from 846 t in 2000 to 1272 t in 2001; 47% of the TAC was taken in 2001 (Table 5). In 2002, the catch (to June 30th) was 2711 t, over double the catch in all of 2001. In addition to reported landings, since 1996 an unknown amount of herring (considered to be less than 400 t) is caught annually in the gill net bait fishery in Fortune Bay.

Effort in the 1980's and 1990's was very low. Gillnet effort (net nights fished per fisher) in the spring fishery peaked in 1997 but has since declined by 87% (Table 31). No effort information is available from the bar seine fishery. There is no purse seine fishery in Fortune Bay.

In recent years, most landings have been by bar seine; in the spring of 2002, this fishery was concentrated in the Long Harbour area. The 2002 gillnet fishery, from early April to late June, was distributed throughout Fortune Bay (Figure 25).

4.5.2 Abundance Indices

Research gill net catch rates (number of fish per nights fished) decreased from 2001 to 2002. Although below average for the 21 year time series, catch rates are still high compared to those for other stocks (Figure 7). This is thought to be reflective of abundance relative to other areas.

The biomass (t) estimated from an acoustic survey in the winter of 2001 was the second lowest in the time series (Table 21). There had been an increasing trend in six surveys conducted between 1986 and 1999. The 2001 estimate was 11% of the peak in 1999. It was concluded that abundance in 2001 was lower than in the 1980's.

Commercial gill net catch rates (kilograms per standard net per nights fished) exhibited no trend and have fluctuated at high levels for several years (Figure 28), suggesting that current abundance is stable at a high level.

Gill net fishers indicated (on a ten point scale) that herring abundance in 2002 was above average and either stable or decreasing marginally (Figure 28). This also suggests that current abundance is high and stable or decreasing marginally.

There was nominal evidence of recruitment. Two recruiting (1998 and 1999) year classes were caught in the 2001 bar seine fishery (Figure 3). Neither year class was caught in the 2001 research gillnets (Figure 6), nor were they detected in the 2001 acoustic survey (Figure 17) suggesting that neither year class is large.

4.5.3 Biological Characteristics

The age composition from the 2001 research gillnet catch was dominated by fish aged 11+ which accounted for approximately 40% of the catch (Figure 6). The 1996 year class was the most dominant individual year class for ages 10 and less, accounting for approximately 20% of the catch. This year class was also dominant in the 2001 fishery (Figure 3) and acoustic survey (Figure 17). The population age structure is considered to be stable due to the substantial contribution of older fish.

Weights at age have decreased continuously during the 1980's and 1990's and, in 2001, were approximately 19% less than in the early 1990's and 24% less than in the early 1980's (Figure 4). This can potentially lead to an increase in fishing mortality per tonne of fish caught.

Herring are smaller at age than in the early 1980's. The length at which 50% of herring matured in 1982-1984 was approximately 31 cm; this decreased to 29 cm in 1999-2001 and would result in a concurrent reduction in fecundity. The age at which 50% of herring mature increased from 4 to 5 (Figure 42). The impact of a reduction in number of eggs deposited due to lower fecundity is uncertain.

4.5.4 Ecological Considerations

No predation information was available for this stock.

Water temperature data were not available for Fortune Bay. However, mean annual water temperatures (at 10 m) in Placentia Bay decreased rapidly from 6.5°C in 1990 to 5.0°C in 1992. Temperatures increased gradually to 7.0°C in 2000, similar to the long-term average (Figure 37). Lower water temperatures in the 1990's may have lead to reduced herring growth rates. Lower temperatures may also adversely affect recruitment (Winters and Wheeler 1987).

Mean annual salinities (at 10 m) at Station 27 off St. John's decreased between 1990 and 1991 and have remained at levels lower than in the 1980's (Figure 38). Lower salinities may also adversely affect recruitment (Winters and Wheeler 1987).

4.5.5 Current Stock Status

Most data show that this stock is still at a high level but it may be decreasing (Table 29). From research gillnet catch rates at age, the 1996 year class has been shown to be of moderate strength, at best. Other mature year classes in the population are considered to be weak.

The status of this stock has not changed since the last assessment in 2000 when it was classified as moderate to good.

4.5.6 Stock Outlook

Given that older fish (age 11+) dominated the research gillnet catch in 2001, it is likely that mature biomass will decrease as these year classes die of natural causes. The 1998 year class was evident only as a small percentage of the commercial catch. There is no evidence of strong recruitment from more recent year classes. Therefore, any change in mature biomass, in the near future, will depend upon the strength of the 1998 year class. Its strength has not been quantified.

The reduction in mean weights at age during the 1990's was coincident with a reduction in fecundity (i.e. eggs deposited per female). Given the uncertainty in the relationship between fecundity and egg survival, the impact of this on recruitment is unknown.

Recruitment has been shown to be influenced by warm over-wintering temperatures and high salinities during the over-wintering period prior to spawning. Although recent water temperatures have been similar to long term averages, salinities have been below normal.

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Table 1. Landings and TAC's ('000 t) of east and southeast Newfoundland herring, by stock area.

	WB-NDB		BB-TB		SMB-PB		FB	
Year	Catch	TAC	Catch	TAC	Catch	TAC	Catch	TAC
1979	15.7	11.5	9.8	8.4	3.6	3.4	1.2	1.0
1980	6.5	5.3	5.4	4.4	2.5	2.5	0.5	1.0
1981	4.7	5.3	4.0	4.8	0.6	1.2	0.1	0.2
1982	2.0	1.2	0.5	0.7	0.1	0.0	0.1	0.0
1983	0.4	0.0	0.1	0.0	0.1	0.0	0.1	0.0
1984	1.5	1.5	0.2	0.4	0.1	0.0	0.1	0.0
1985	1.8	2.0	0.6	0.8	0.1	0.6	0.1	0.3
1986	2.8	5.5	1.8	3.8	0.1	2.1	0.1	0.7
1987	13.5	32.5	6.1	13.7	0.3	2.5	0.1	2.4
1988	7.4	34.7	11.7	16.2	1.1	8.9	0.1	4.7
1989	6.4	14.0	4.9	6.9	0.4	1.5	0.1	1.5
1990	5.1	16.5	3.7	23.4	0.5	1.5	0.1	1.5
1991	8.7	13.5	9.1	10.0	1.0	1.5	0.1	1.5
1992	5.6	13.5	4.6	10.0	0.9	1.5	0.1	1.5
1993	1.7	13.5	2.3	10.0	1.1	1.5	0.2	1.5
1994	1.4	13.5	2.7	10.0	1.0	1.5	0.3	1.5
1995	1.6	1.2	1.5	1.0	0.8	1.1	0.5	1.5
1996	0.7	1.6	1.1	1.4	0.5	0.7	0.1	0.5
1997	2.5	4.9	1.1	1.6	4.0	6.6	0.1	5.4
*1998	0.7	2.5	1.0	2.5	2.3	2.0	0.1	5.4
*1999	1.1	2.5	1.4	2.5	0.3	2.0	0.5	5.4
*2000	1.1	1.1	1.1	2.5	0.5	2.0	0.8	5.4
*2001	0.02	1.1	0.5	3.5	0.5	2.0	1.3	2.7

* provisional

Table 2. White Bay (WB) - Notre Dame Bay (NDB) herring landings and TAC's (t) by gear, 1990-2001

Year	Area	Purse Seine	Ringnet	Midwater Trawl	Bar Seine	Gillnet	Trap	Total	TAC
1990	WB	108	-	-	1	90	21	220	
	NDB	3398	-	-	30	1289	151	4868	
	Combined	3506	-	-	31	1379	172	5088	16500
1991	WB	1318	-	-	2	311	23	1654	
	NDB	6026	-	-	80	946	41	6872	
	Combined	7344	-	-	82	1257	64	8526	13500
1992	WB	1252	-	-	-	252	4	1508	
	NDB	2964	-	-	6	1102	48	4120	
	Combined	4216	-	-	6	1354	52	5628	13500
1993	WB	121	-	-	-	34	-	155	
	NDB	686	-	-	104	739	2	1531	
	Combined	807	-	-	104	773	-	1686	13500
1994	WB	145	-	-	5	20	59	229	
	NDB	234	-	-	84	859	-	1177	
	Combined	379	-	-	89	879	59	1406	13500
1995	WB	201	-	-	1	15	9	225	
	NDB	454	-	-	25	890	-	1369	
	Combined	655	-	-	26	905	9	1594	1200
1996	WB	184	-	-	-	1	-	185	
	NDB	252	-	-	-	229	-	481	
	Combined	435	-	-	-	230	-	665	1600
1997	WB	11	-	-	-	10	57	78	
	NDB	2364	-	-	-	11	7	2382	
	Combined	2375	-	-	-	21	64	2460	4900
1998*	WB	106	-	-	-	1	7	114	
	NDB	500	-	-	7	30	2	539	
	Combined	606	-	-	7	31	9	653	2500
1999*	WB	-	-	-	-	-	-	-	
	NDB	1011	-	-	-	34	-	1045	
	Combined	1011	-	-	-	34	-	1045	2500
2000*	WB	74	-	-	-	3	2	79	
	NDB	997	-	-	-	16	1	1014	
	Combined	1071	-	-	-	19	3	1093	2500
2001*	WB	13	-	-	-	4	4	21	
	NDB	-	-	-	-	-	1	1	
	Combined	13	-	-	-	4	5	22	1100

* provisional

Table 3. Bonavista Bay (BB) - Trinity Bay (TB) herring landings and TAC's (t), by gear, 1990-2001

Year	Area	Purse Seine	Ringnet	Midwater Trawl	Bar Seine	Gillnet	Trap	Total	TAC
1990	BB	904	-	-	2	126	7	1039	
	TB	1819	-	-	721	84	24	2648	
	Combined	2723	-	-	723	210	31	3687	23400
1991	BB	4458	-	-	7	147	43	4655	
	TB	3760	-	-	567	85	-	4412	
	Combined	8218	-	-	574	232	43	9067	10000
1992	BB	4209	-	-	3	197	2	4411	
	TB	51	-	-	63	44	-	158	
	Combined	4260	-	-	66	241	2	4569	10000
1993	BB	2001	-	-	4	234	-	2239	
	TB	31	-	-	2	72	1	106	
	Combined	2032	-	-	6	306	1	2345	10000
1994	BB	1984	-	-	1	357	1	2342	
	TB	39	-	-	235	71	1	346	
	Combined	2023	-	-	236	428	2	2688	10000
1995	BB	427	-	-	6	520	-	954	
	TB	271	-	-	133	91	2	497	
	Combined	698	-	-	139	611	2	1451	1000
1996	BB	345	-	-	-	300	1	645	
	TB	13	-	-	13	78	-	410	
	Combined	358	-	-	13	378	-	1054	1400
1997	BB	321	-	-	-	72	1	394	
	TB	329	-	-	211	129	41	710	
	Combined	650	-	-	211	201	42	1104	1600
1998*	BB	331	-	-	96	148	-	575	
	TB	333	-	-	8	22	22	385	
	Combined	661	-	-	104	170	22	960	2500
1999*	BB	564	-	-	222	95	-	881	
	TB	245	-	-	208	100	-	553	
	Combined	809	-	-	430	195	-	1434	2500
2000*	BB	493	-	-	195	135	8	831	
	TB	2	-	-	190	67	-	259	
	Combined	495	-	-	385	202	-	1090	2500
2001*	BB	241	-	-	16	37	-	294	
	TB	18	-	-	155	19	-	192	
	Combined	259	-	-	171	56	-	486	3500

* provisional

Table 4. St. Mary's Bay (SMB) - Placentia Bay (PB) herring landings and TAC's (t) by gear, 1990-2001

Year	Area	Purse Seine	Ringnet	Midwater Trawl	Bar Seine	Gillnet	Trap	Total	TAC
1990	SMB	-	-	-	-	18	-	18	
	PB	379	-	-	-	144	-	523	
	Combined	379	-	-	-	162	-	541	1500
1991	SMB	-	-	-	-	16	-	16	
	PB	742	-	-	110	104	34	990	
	Combined	742	-	-	110	120	34	1006	1500
1992	SMB	-	-	-	-	2	-	2	
	PB	781	-	-	2	125	-	908	
	Combined	781	-	-	2	127	-	910	1500
1993	SMB	262	-	-	-	3	-	265	
	PB	667	-	-	84	119	-	870	
	Combined	929	-	-	84	122	-	1135	1500
1994	SMB	-	-	-	-	1	-	1	
	PB	681	-	-	78	194	10	962	
	Combined	681	-	-	78	195	10	963	1500
1995	SMB	219	-	-	-	1	-	220	
	PB	332	-	-	76	135	-	543	
	Combined	551	-	-	76	136	-	763	1100
1996	SMB	217	-	-	-	1	-	217	
	PB	229	-	-	15	37	-	282	
	Combined	446	-	-	15	37	-	499	700
1997	SMB	1650	-	-	-	1	-	1651	
	PB	2186	-	-	100	20	-	2306	
	Combined	3836	-	-	100	21	-	3957	6600
1998*	SMB	740	-	-	-	14	-	754	
	PB	1570	-	-	-	5	-	1575	
	Combined	2310	-	-	-	19	-	2329	2000
1999*	SMB	-	-	-	-	-	-	-	
	PB	330	-	-	-	1	-	331	
	Combined	330	-	-	-	1	-	331	2000
2000*	SMB	-	-	-	-	-	-	-	
	PB	448	-	-	41	2	-	491	
	Combined	448	-	-	41	2	-	491	2000
2001*	SMB	57	-	-	-	-	-	57	
	PB	394	-	-	26	39	-	459	
	Combined	451	-	-	26	39	-	516	2000

* provisional

Table 5 Fortune Bay (FB) herring landings and TAC's (t) by gear, 1990-2001

Year	Purse Seine	Ringnet	Midwater Trawl	Bar Seine	Gillnet	Trap	Total	TAC
1990	-	-	-	-	92	-	92	1500
1991	-	-	-	-	123	-	123	1500
1992	-	-	-	-	130	-	130	1500
1993	-	-	-	-	175	-	175	1500
1994	1	-	-	2	250	-	253	1500
1995	5	-	-	4	460	-	469	1500
1996	-	-	-	35	31	4	70	500
1997	-	-	-	92	28	23	143	5400
1998*	-	-	-	-	1	-	1	5400
1999*	-	-	-	338	29	89	455	5400
2000*	-	-	-	796	16	34	846	5400
2001*	-	-	-	1081	-	190	1272	2700

* provisional

Table 6. Commercial catch (t) and number of fish sampled (bold print) for 2000, by stock area, gear type and month. Boxed areas indicate the catch – sample combinations used for calculating commercial catch at age

AREA	GEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
WB-NDB	Gillnet					16 **50**			1	2			**50**
	Purse seine									1	74 **50**	996 **150**	
	Bar Seine												
	Trap									1	2 **50**		
BB-TB	Gillnet				118 **100**	60 **50**	2				12 **50**	10 **50**	2 **50**
	Purse seine									261	234 **150**	**50**	
	Bar Seine				299 **100**	4					22	61	
	Trap					2					2	3	
SMB-PB	Gillnet				2 **50**								
	Purse seine			188 **150**	260 **50**								
	Bar Seine			9 **50**		32 **50**							
	Trap												
FB	Gillnet		1	8	4 **40**	4							
	Purse seine												
	Bar Seine			101 **50**	514	180 **50**							
	Trap			11 **50**	6	17							

Table 7. Commercial catch at age of spring and autumn spawning herring for White Bay – Notre Dame Bay, 1972-2001.

Spring Spawners

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	195
2	5	1	1	2	56	50	1	1	115	445	76	1	6	3	29
3	290	727	4	128	24	1671	55	60	46	152	371	38	12	187	975
4	2396	1411	123	215	506	107	2034	50	1240	41	332	46	124	350	2945
5	353	2825	3142	453	237	468	317	2928	92	1231	59	23	1218	240	308
6	69	761	5446	5438	868	184	1034	323	1080	63	268	14	73	1486	667
7	122	719	1193	7069	10893	793	517	1410	17	805	34	93	114	108	1258
8	403	654	697	1123	17145	7363	2509	767	496	64	258	1	157	275	198
9	1363	416	1506	838	1328	12675	10807	2222	179	344	19	26	37	94	162
10	205	1685	850	810	3364	1055	11756	14413	1450	194	192	4	122	81	179
11+	808	794	2378	3999	8535	15707	14379	27508	14653	10908	4059	805	1938	2110	1973
Total	6015	9994	15349	20076	42957	40074	43410	49683	19369	14248	5669	1052	3802	4935	8889

Age	b 1987	c 1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	a 1998	a 1999	a 2000	a 2001
1	26	3113	1	1	2273	1	1	1	1	1	1	1	1	1	1
2	1105	407	23	1	29	940	1	1	1	159	2	1	1	1	116
3	324	1044	128	1936	386	207	96	1	96	1	696	796	75	404	8
4	7201	291	613	285	16183	942	31	1054	609	3	2	921	1666	175	12
5	25843	2984	124	637	1542	8940	263	121	2747	484	63	20	1383	1747	2
6	1651	11819	3106	240	553	483	3614	1674	129	1194	3420	16	5	946	14
7	1067	1036	10566	2451	103	371	75	2199	701	23	2939	351	5	2	1
8	2088	1137	370	7360	2145	211	199	108	1513	162	51	224	110	1	1
9	399	1454	1081	532	4432	722	70	192	183	474	209	213	222	57	1
10	442	315	844	1132	537	2796	544	49	127	1	359	41	5	28	1
11+	4566	2943	2178	1148	2201	3509	861	441	337	91	427	90	17	62	1
Total	44712	26543	19034	15723	30384	19122	5755	5841	6444	2593	8171	2674	3490	3424	158

Autumn Spawners

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	53	1	1	6	1	1	1	1	71	1	72	1	1	1	10
4	17	7	11	64	31	45	6	1	13	13	26	74	60	29	67
5	74	22	124	3	35	35	24	10	13	86	62	25	409	94	69
6	79	25	10	25	51	85	155	267	23	11	16	23	66	333	79
7	67	60	48	16	20	54	171	172	272	1	12	1	30	137	373
8	1	25	2	21	40	1	24	160	4	100	9	1	8	32	68
9	164	13	46	3	46	94	2	133	19	1	42	6	7	23	6
10	81	97	7	2	4	1	130	1	1	4	1	1	3	10	1
11+	562	298	346	302	329	182	238	298	450	65	29		24	74	42
Total	1100	550	597	444	559	500	753	1045	868	284	265	134	610	735	717

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	a 1998	a 1999	a 2000	a 2001
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	11	1	1	1	1	1	1
3	2	1	1	1	1	1	1	1	1	19	1	1	1	28	7
4	297	92	65	130	188	109	1	7	11	1	56	106	192	176	1
5	469	115	12	65	450	167	48	70	37	1	72	26	120	613	1
6	156	45	5	52	98	172	78	80	2	80	20	1	152	169	1
7	112	20	574	84	36	48	113	137	120	16	233	1	40	139	1
8	630	7	70	37	126	46	79	25	3	3	1	13	1	2	1
9	152	560	1	1	249	80	42	4	24	3	69	20	1	28	1
10	10	6	533	4	120	19	21	1	1	3	1	1	1	1	1
11+	108	306	29	577	2733	613	349	14	204	1	34	1	115	28	1
Total	1938	1154	1292	953	4005	1277	734	341	415	129	489	172	625	1186	17

Spring and Autumn Spawners

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Total	7115	10544	15946	20520	43516	40574	44163	50728	20237	14532	5934	1186	4412	5670	15
% SS	84.5	94.8	96.3	97.8	98.7	98.8	98.3	97.9	95.7	98.0	95.5	88.7	86.2	87.0	93.3
% AS	15.5	5.2	3.7	2.2	1.3	1.2	1.7	2.1	4.3	2.0	4.5	11.3	13.8	13.0	6.7

	b 1987	c 1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	a 1998	a 1999	a 2000	a 2001
Total	46650	27697	20326	16676	34389	20399	6489	6182	6859	2722	8660	2846	4115	4610	175
% SS	95.8	95.8	93.6	94.3	88.4	93.7	88.7	94.5	94.0	95.3	94.4	94.0	84.8	74.3	90.3
% AS	4.2	4.2	6.4	5.7	11.6	6.3	11.3	5.5	6.0	4.7	5.6	6.0	15.2	25.7	9.7

a - preliminary
b - also 4475 age 0 SS
c - also 10 age 0 SS

Table 8 Commercial catch at age of spring and autumn spawning herring for Bonavista Bay - Trinity Bay 1972-2001

Spring Spawners

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	1	1	1	1	5	10	1	1	1	1	1	1	1	1	151
2	1	1	1	1	14	16	22	6	15	136	1	1	4	13	207
3	10	1	1	392	77	248	26	286	13	246	8	4	22	175	443
4	1347	60	2	134	493	135	357	167	195	53	11	34	35	70	4445
5	389	4887	235	163	123	759	122	765	43	256	2	7	210	87	261
6	91	126	4795	2564	166	227	251	19	293	26	30	2	9	351	161
7	75	96	424	14330	4897	50	112	436	52	288	5	15	5	37	262
8	86	1	151	455	20697	6209	596	101	264	23	35	1	12	27	38
9	480	48	294	995	909	23206	4412	530	75	321	5	8	2	13	10
10	14	271	69	727	854	774	13394	5575	967	88	65	2	2	22	31
11+	213	1	1849	1679	4306	5890	5956	19994	12259	11762	1186	159	154	797	657
Total	2709	5493	7822	21441	32541	37524	25251	27880	14177	13200	1349	234	456	1593	6666

Age	1987 [c]	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 [a]	1999 [a]	2000 [a]	2001 [a]
1	296	717	1	1	115	1	1	1	4	1	1	1	1	48	1
2	1352	6612	563	58	689	499	354	1	1	1	75	57	50	355	197
3	413	9910	1043	3094	210	1056	621	394	107	23	302	533	47	205	252
4	2845	267	3323	422	13551	271	160	819	2645	63	13	507	746	215	188
5	16208	3674	264	2350	2586	12612	344	303	349	2638	96	93	545	764	33
6	334	21739	1428	94	3859	2422	3779	1072	64	345	3230	135	9	388	54
7	359	782	8639	629	347	579	422	3678	152	46	182	1388	14	48	139
8	126	713	13	4439	1550	194	385	479	978	157	7	98	1537	23	39
9	33	8	216	235	7505	1394	132	471	172	430	1	4	895	904	1
10	6	55	100	325	447	2054	657	530	163	11	29	4	55	111	5
11+	956	1247	508	466	891	653	1092	2614	649	300	94	86	104	223	137
Total	22926	45724	16096	12113	31750	21735	7947	10562	5284	4015	4030	2908	4003	3287	1046

Autumn Spawners

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	10	1	1	1	14	6	3	1	1	1	1
4	1	1	1	26	22	55	16	1	11	115	1	10	3	5	51
5	1	1	1	30	77	16	14	27	17	106	8	2	84	18	60
6	1	1	1	1	23	176	61	114	83	33	10	5	14	203	59
7	2	1	16	22	66	86	58	30	188	83	3	2	17	96	292
8	2	48	2	41	34	112	26	175	45	263	8	1	3	54	149
9	5	1	1	6	62	30	23	13	112	36	25	1	5	22	24
10	1	1	1	19	8	73	82	16	3	4	1	1	1	10	1
11+	33	1	1216	259	1069	1069	417	800	463	230	37	3	9	29	30
Total	49	58	1242	407	1373	1620	702	1179	936	898	98	28	139	440	669

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 [a]	1999 [a]	2000 [a]	2001 [a]
1	19	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	253	1	1	1	1	1	1	13	1	1	1	22	1	1
3	1	54	1	5	6	1	11	1	6	1	33	1	58	41	74
4	2	22	55	139	140	10	1	1	39	1	63	239	61	77	28
5	391	88	76	55	837	219	146	53	90	119	26	324	184	137	57
6	237	357	136	9	152	205	205	168	4	126	68	121	249	110	224
7	87	216	237	61	17	118	163	27	1	16	39	138	38	174	116
8	360	202	18	50	99	1	121	114	48	29	3	76	56	103	165
9	138	818	83	58	104	5	39	1	24	11	6	2	61	11	64
10	2	2	697	19	125	1	14	1	1	1	19	35	57	37	13
11+	156	237	193	89	481	167	376	79	206	20	4	16	20	165	177
Total	1394	2250	1498	487	1963	729	1078	446	433	326	283	954	807	857	920

Spring and Autumn Spawners

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985 [b]	1986
Total	2758	5551	9064	21848	33914	39144	25953	29059	15115	14098	1447	262	595	2033	7355
% SS	98.2	99.0	86.3	98.1	96.0	95.9	97.3	95.9	93.8	93.6	93.2	89.3	76.6	78.4	90.6
% AS	1.8	1.0	13.7	1.9	4.0	4.1	2.7	4.1	6.2	6.4	6.8	10.7	23.4	21.6	9.4

	1987 [c]	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 [a]	1999 [a]	2000 [a]	2001 [a]
Total	24322	47974	17596	12600	33713	22464	9025	11008	5717	4341	4313	3862	4810	4144	1966
% SS	94.3	95.3	91.5	96.1	94.2	96.8	88.1	95.9	92.4	92.5	93.4	75.3	83.2	79.3	53.2
% AS	5.7	4.7	8.5	3.9	5.8	3.2	11.9	4.1	7.6	7.5	6.6	24.7	16.8	20.7	46.8

a - preliminary
b - also 10 age 0 SS
c - also 3124 age 0 SS

Table 9. Commercial catch at age of spring and autumn spawning herring for St. Mary's Bay - Placentia Bay, 1972-2001

Spring Spawners

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1
2	1	76	995	74	365	52	30	87	133	1	1	1	6	1	1
3	207	326	280	2234	391	1423	175	663	332	193	1	5	9	7	1
4	20375	77	234	471	1906	140	1817	279	133	42	2	2	24	18	143
5	725	15470	126	147	208	736	123	2263	153	111	3	3	36	27	19
6	5154	566	14328	1591	267	67	596	96	1270	51	8	2	6	21	28
7	365	6757	436	13858	862	50	64	614	57	338	3	4	3	15	9
8	650	93	6049	146	5622	1039	106	85	470	28	14	1	24	3	4
9	352	224	138	3391	201	3630	512	66	38	80	4	9	1	25	1
10	73	193	238	350	225	134	3827	501	237	6	4	1	10	5	5
11+	403	315	624	1323	1361	2448	2185	4785	2971	466	69	39	44	125	30
Total	28306	24098	23451	23586	13440	9940	9436	9440	5795	1317	110	68	166	248	242

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 a	1999 a	2000 a	2001 a
1	1	1	1	1	1	1	1	13	1	1	1	1	1	1	1
2	34	1	22	1	37	68	5	24	1	19	235	151	1	1	1
3	19	1	48	115	1	47	62	137	333	19	125	487	21	12	1
4	2	22	9	189	222	7	34	5	1418	224	1	205	21	579	11
5	502	163	1	64	160	363	11	36	37	1187	1656	61	1	156	329
6	29	2457	24	15	170	231	187	6	1	94	8237	673	1	63	80
7	47	119	463	30	12	55	118	225	1	43	465	3222	84	60	64
8	9	213	34	494	110	53	74	60	63	32	134	299	292	290	39
9	3	16	100	45	493	74	63	98	1	51	76	186	42	127	268
10	1	36	5	172	88	383	56	172	16	16	50	43	21	36	153
11+	11	147	34	128	948	965	1174	1042	416	177	280	109	63	391	354
Total	658	3176	741	1254	2242	2247	1785	1818	2288	1863	11260	5637	548	1715	1301

Autumn Spawners

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	24	5	2	1	11	1	1	1	1	1	1	1	1	1	1
4	61	150	2	7	4	47	23	11	96	139	1	18	17	9	16
5	175	52	96	68	214	52	435	143	35	116	7	6	101	20	24
6	15	71	146	182	67	209	92	598	52	10	1	12	32	86	15
7	61	10	80	89	32	81	244	73	419	11	1	4	21	48	97
8	37	54	95	206	17	69	122	216	79	50	1	1	5	36	28
9	101	17	93	6	94	26	38	21	126	7	1	1	3	10	16
10	71	68	51	37	11	22	52	2	25	1	1	1	1	3	4
11+	539	737	970	677	329	526	561	348	492	29	2	4	8	24	15
Total	1086	1166	1537	1275	781	1035	1570	1415	1327	366	18	50	191	237	218

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 a	1999 a	2000 a	2001 a
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	4	1	5	7	1	1	1	1	1	1	1	1	1	1	1
4	12	20	5	37	14	7	2	7	1	19	76	61	1	11	1
5	32	30	18	61	87	8	208	62	105	40	295	231	1	16	2
6	80	239	8	54	40	50	239	116	112	82	188	445	1	72	83
7	30	90	56	24	23	33	173	182	35	102	1231	273	42	46	209
8	82	35	43	47	65	27	41	231	106	10	1361	764	63	96	185
9	24	270	67	58	98	64	41	182	99	19	229	694	104	30	174
10	3	5	178	17	40	1	3	1	87	9	306	376	63	26	2
11+	12	53	164	173	495	479	863	411	282	74	730	255	125	89	103
Total	282	745	546	480	865	672	1573	1201	907	358	4468	3124	506	397	768

Spring and Autumn Spawners

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Total	29392	25264	24988	24861	14221	10975	11006	10855	7122	1683	128	118	357	485	460
% SS	96.3	95.4	93.8	94.9	94.5	90.6	85.7	87.0	81.4	78.3	85.9	57.6	46.5	51.1	52.6
% AS	3.7	4.6	6.2	5.1	5.5	9.4	14.3	13.0	18.6	21.7	14.1	42.4	53.5	48.9	47.4

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 a	1999 a	2000 a	2001 a
Total	940	3921	1287	1734	3107	2919	3358	3019	3195	2221	15728	8761	1054	2112	2069
% SS	70.0	81.0	57.6	72.3	72.2	77.0	53.2	60.2	71.6	83.9	71.6	64.3	52.0	81.2	62.9
% AS	30.0	19.0	42.4	27.7	27.8	23.0	46.8	39.8	28.4	16.1	28.4	35.7	48.0	18.8	37.1

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Table 10 Commercial catch at age of spring and autumn spawning herring for Fortune Bay, 1972-2001

Spring Spawners

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	617	23	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1515	2210	389	2	82	27	1	1	25	1	1	1	2	1	1
3	256	925	1314	277	15	2103	42	1	16	144	1	2	1	54	1
4	19690	67	552	581	318	25	2677	183	3	16	3	2	4	3	145
5	2896	5694	130	112	228	327	62	3833	69	4	3	1	3	39	4
6	10767	475	4435	87	129	166	237	15	1122	3	1	1	2	12	69
7	351	1712	250	1490	11	26	43	165	7	21	2	1	1	2	20
8	4432	73	1094	16	338	43	139	5	183	2	36	1	2	1	6
9	991	282	36	142	36	188	52	24	1	23	1	10	1	1	1
10	34	558	117	22	188	4	326	1	11	1	5	1	2	1	2
11+	366	173	255	201	140	244	302	167	50	12	5	18	23	15	14
Total	41915	12192	8573	2931	1486	3154	3882	4396	1488	228	59	39	42	130	264

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 a	1999 a	2000 a	2001 a
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	464
3	1	1	1	1	1	1	2	6	1	1	1	1	108	1	112
4	1	1	1	1	23	1	1	1	1	201	1	1	27	193	122
5	304	1	1	2	8	3	1	2	14	12	1	1	1	1	3159
6	11	219	18	2	1	1	327	1	14	17	1	1	48	18	196
7	49	7	274	12	1	1	2	24	24	1	1	1	816	102	94
8	18	26	1	155	6	1	3	9	569	1	1	1	152	1239	215
9	4	6	17	17	274	2	8	23	36	47	1	1	120	195	540
10	1	1	11	20	1	75	10	8	36	6	15	1	1	191	151
11+	38	10	24	1	72	266	217	647	728	38	355	1	478	830	712
Total	429	274	350	213	389	353	573	723	1425	326	379	11	1753	2772	5766

Autumn Spawners

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	7	1	7	1	1	1	1	5	1	1	1	1	1
4	1	48	9	22	9	23	1	7	4	64	1	1	1	17	3
5	84	50	87	12	38	19	36	5	3	16	7	1	9	4	8
6	25	79	65	39	26	19	6	50	3	1	2	2	4	26	16
7	185	8	12	19	13	1	25	1	3	1	1	1	6	12	38
8	44	32	27	20	1	1	12	17	1	1	1	1	1	7	12
9	310	15	5	11	27	1	6	12	1	1	1	1	1	4	5
10	125	27	1	7	1	1	1	1	1	1	1	1	1	1	1
11+	793	97	85	45	9	2	18	12	1	1	1	1	1	2	5
Total	1570	359	300	178	133	70	108	108	20	93	18	12	27	76	91

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 a	1999 a	2000 a	2001 a
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10
4	1	2	3	10	1	1	1	1	1	1	1	1	1	8	1
5	4	1	6	5	1	4	1	1	1	1	1	1	1	25	65
6	7	5	1	12	8	5	3	1	1	1	1	1	1	26	205
7	11	5	6	17	1	3	11	1	25	1	1	1	27	44	75
8	25	1	31	7	3	1	1	1	31	1	1	1	1	36	65
9	10	13	3	54	1	1	1	1	10	2	1	1	1	6	1
10	5	1	17	1	3	1	1	1	1	1	1	1	1	16	84
11+	14	10	5	5	1	5	26	14	1	1	1	1	2	148	251
Total	80	41	75	114	22	24	48	24	74	12	11	11	38	312	759

Spring and Autumn Spawners

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Total	43485	12551	8873	3109	1619	3224	3990	4504	1508	321	77	51	69	206	355
% SS	96 4	97 1	96 6	94 3	91 8	97 8	97 3	97 6	98 7	71 0	76 6	76 5	60 9	63 1	74 4
% AS	3 6	2 9	3 4	5 7	8 2	2 2	2 7	2 4	1 3	29 0	23 4	23 5	39 1	36 9	25 6

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 a	1999 a	2000 a	2001 a
Total	509	315	425	327	411	377	621	747	1499	338	390	22	1791	3084	6525
% SS	84 3	87 0	82 4	65 1	94 6	93 6	92 3	96 8	95 1	96 4	97 2	50 0	97 9	89 9	88 4
% AS	15 7	13 0	17 6	34 9	5 4	6 4	7 7	3 2	4 9	3 6	2 8	50 0	2 1	10 1	11 6

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Table 11. Mean weights at age (g) of spring-spawning herring, by stock area, from samples collected January to June, 1996 – 2001. Sample sizes are in parenthesis.

Stock Area	Age	1996		1997		1998		1999		2000		2001	
WB-NDB	0	-	-	-	-	-	-	-	-	-	-	-	-
	1	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	106	(1)
	3	-	-	106	(8)	112	(33)	-	-	116	(6)	134	(12)
	4	154	(1)	-	-	147	(375)	155	(277)	170	(37)	149	(204)
	5	167	(124)	230	(1)	170	(1)	176	(363)	193	(184)	185	(51)
	6	201	(703)	192	(175)	201	(3)	216	(5)	214	(130)	215	(325)
	7	239	(31)	223	(332)	227	(42)	245	(3)	261	(2)	238	(120)
	8	254	(62)	250	(25)	237	(160)	254	(58)	302	(2)	265	(2)
	9	274	(198)	259	(48)	248	(5)	259	(85)	300	(4)	330	(3)
	10	289	(12)	292	(80)	283	(21)	294	(12)	320	(6)	327	(2)
	11+	371	(49)	354	(93)	363	(185)	340	(78)	378	(44)	336	(5)
BB-TB	0	-	-	-	-	-	-	-	-	-	-	-	-
	1	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	101	(4)	97	(1)
	3	-	-	115	(13)	143	(12)	168	(1)	139	(4)	145	(45)
	4	161	(7)	-	-	172	(60)	187	(262)	186	(26)	164	(44)
	5	189	(827)	203	(19)	219	(2)	207	(108)	225	(209)	194	(24)
	6	215	(127)	214	(1044)	238	(18)	234	(6)	243	(122)	243	(182)
	7	258	(31)	235	(128)	245	(746)	246	(12)	251	(15)	261	(72)
	8	271	(40)	272	(36)	254	(59)	275	(574)	276	(8)	283	(12)
	9	280	(135)	287	(33)	256	(2)	282	(26)	312	(450)	288	(18)
	10	308	(20)	301	(91	293	(16)	287	(4)	325	(50)	304	(106)
	11+	345	(194)	341	(179)	339	(74)	340	(34)	332	(53)	328	(208)
SMB-PB	0	-	-	-	-	-	-	-	-	-	-	-	-
	1	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	71	(4)	79	(7)	157	(4)	113	(6)	79	(5)
	3	-	-	122	(19)	130	(161)	143	(266)	135	(56)	138	(15)
	4	170	(179)	112	(1)	178	(37)	175	(72)	170	(219)	166	(16)
	5	224	(499)	211	(134)	205	(4)	198	(27)	192	(50)	189	(170)
	6	270	(34)	251	(562)	258	(37)	-	-	228	(130)	244	(104)
	7	301	(16)	278	(64)	286	(376)	264	(50)	239	(7)	266	(32)
	8	353	(4)	312	(16)	300	(57)	309	(147)	271	(38)	289	(13)
	9	349	(21)	317	(8)	328	(14)	298	(17)	300	(53)	280	(25)
	10	388	(2)	331	(4)	326	(7)	322	(8)	306	(24)	312	(37)
	11+	426	(97)	413	(126)	424	(68)	394	(57)	352	(66)	341	(120)
FB	0	-	-	-	-	-	-	-	-	-	-	-	-
	1	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	79	(10)
	3	-	-	121	(7)	99	(1)	103	(787)	-	-	128	(2)
	4	167	(61)	168	(4)	186	(2)	152	(38)	148	(94)	177	(7)
	5	205	(89)	190	(274)	-	-	185	(23)	186	(25)	179	(365)
	6	237	(77)	226	(152)	227	(302)	217	(18)	218	(9)	214	(69)
	7	256	(8)	262	(90)	250	(71)	249	(285)	226	(8)	251	(57)
	8	292	(12)	285	(12)	281	(90)	279	(113)	255	(126)	260	(60)
	9	309	(150)	287	(14)	292	(11)	303	(37)	296	(137)	278	(133)
	10	337	(16)	317	(66)	320	(13)	323	(17)	311	(36)	303	(75)
	11+	391	(257)	384	(326)	360	(185)	373	(242)	361	(232)	338	(287)

Table 12. Commercial catch (t) and number of fish sampled (bold print) for 2001, by stock area, gear type and month. Boxed areas indicate the catch – sample combinations used for calculating commercial catch at age.

AREA	GEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
WB-NDB	Gillnet						4 **50**				1 **50**		
	Purse seine										13 **50**		
	Bar Seine												
	Trap									5 **50**			
BB-TB	Gillnet				3 141	26 **98** 14	1 1				6 **50**	19	1
	Purse seine										134 **50**	125	
	Bar Seine										12	4	
	Trap												
SMB-PB	Gillnet	1				7	31 **50**						
	Purse seine				423 **50**		29 **50**						
	Bar Seine						26 **40**						
	Trap												
FB	Gillnet												
	Purse seine												
	Bar Seine				229 **100**		853 **100**						
	Trap				13		177			1 **50**			

Table 13. Spring research gill net catch rates at age (numbers per days fished), spring spawners only, by stock area and year.

White Bay - Notre Dame Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1							0.0	0.0	0.0	0.0	0.0
2							0.0	0.0	0.0	0.0	0.0
3							4.7	16.0	83.5	11.0	0.0
4							1.9	43.3	51.6	247.1	21.5
5							22.2	11.2	52.9	28.8	493.7
6							59.6	126.9	16.3	13.7	33.5
7							5.6	182.9	144.6	7.5	13.7
8							4.7	9.7	195.5	84.2	10.3
9							12.0	16.0	11.5	164.3	47.2
10							1.8	24.3	26.5	21.9	127.9
11+							34.1	56.4	97.1	106.1	110.8
Total							146.4	486.4	678.8	684.6	858.6

Age	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	
3	1.2	0.6	0.0	0.0	3.2	7.9	6.5	0.3	0.6	
4	10.9	232.0	18.5	0.9	0.6	117.6	70.3	2.6	46.4	
5	51.0	14.6	300.1	47.9	3.2	0.2	85.1	14.7	9.3	
6	359.9	52.1	20.2	286.0	77.1	1.2	1.0	16.8	39.9	
7	18.8	182.7	45.9	12.7	139.5	10.3	0.4	0.3	16.4	
8	6.7	14.1	104.1	21.6	8.6	43.3	9.5	2.3	0.1	
9	13.4	7.6	8.4	74.2	17.6	1.7	15.0	0.9	0.2	
10	29.7	12.9	9.5	5.2	31.0	6.9	2.8	0.3	0.7	
11+	115.9	69.1	52.1	21.1	39.4	56.8	18.0	0.6	0.1	
Total	606.9	585.7	559.8	469.5	320.0	246.0	202.1	48.8	113.6	32.8

Bonavista Bay - Trinity Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1							0.0	0.0	0.0	0.0	0.0
2							0.1	0.1	0.0	0.0	0.0
3							5.6	2.3	8.8	0.9	0.3
4							0.3	21.8	8.2	50.1	1.2
5							2.3	0.9	27.7	12.0	46.2
6							29.2	5.5	4.5	27.9	8.1
7							0.5	57.7	12.2	3.2	10.3
8							0.4	0.9	60.8	19.8	2.3
9							0.6	0.6	0.8	62.3	17.6
10							0.0	0.7	3.2	3.8	34.8
11+							12.2	5.5	8.9	8.3	16.8
Total							51.2	96.1	135.1	188.2	137.6

Age	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	
3	2.6	0.7	0.0	0.0	2.8	1.2	0.1	0.1	4.1	
4	1.7	16.6	34.3	0.9	0.0	5.7	17.6	2.6	4.4	
5	8.2	9.6	8.2	140.9	3.3	0.2	7.2	11.9	2.9	
6	50.6	12.6	1.7	20.8	181.9	1.7	0.4	5.8	14.2	
7	6.4	65.0	4.6	5.3	23.7	62.3	0.8	0.4	3.5	
8	7.0	6.5	19.9	5.5	5.6	4.6	29.8	0.2	0.6	
9	3.7	8.9	2.6	20.8	7.0	2.1	1.4	12.7	1.1	
10	13.1	7.5	3.0	3.7	16.7	1.3	0.3	4.1	4.5	
11+	20.2	40.1	25.0	31.4	38.2	5.9	2.3	2.6	5.7	
Total	113.5	167.6	99.2	229.1	278.9	83.0	59.9	40.5	41.1	22.4

Table 13 (cont.) Spring research gill net catch rates at age (numbers per days fished) spring spawners only by stock area and year

St. Mary's Bay - Placentia Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.2	1.6	0.7	0.0	0.0	0.0	0.4	0.2	0.1	0.1	0.0
3	0.2	10.2	18.6	59.3	0.3	13.7	2.3	23.5	11.2	0.9	2.7
4	0.6	1.8	21.9	5.9	125.6	1.7	4.2	6.0	19.5	16.5	0.7
5	0.4	0.9	7.0	9.9	8.5	152.1	2.7	1.8	5.7	7.1	21.8
6	1.4	1.0	2.7	6.9	17.4	11.6	100.2	3.5	2.4	1.9	3.8
7	0.2	3.2	0.9	2.4	3.4	17.7	6.2	64.3	5.0	0.5	2.4
8	1.7	0.4	7.3	2.1	2.6	4.0	14.4	3.3	69.9	1.1	1.0
9	0.4	4.7	0.2	8.6	0.1	2.1	3.0	12.6	2.4	8.3	1.6
10	0.4	0.5	10.1	2.7	2.4	0.6	0.1	3.1	16.7	1.1	7.5
11+	6.5	19.4	47.0	45.4	12.1	7.4	7.2	4.9	6.8	4.8	13.1
Total	11.9	43.8	116.3	143.1	172.5	210.7	140.7	123.2	139.5	42.3	54.8

Age	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.2	0.0	0.0	0.0	0.0	0.6	1.1	0.2	0.4	
3	3.5	15.6	11.3	0.0	4.1	22.6	67.7	11.6	6.2	
4	3.3	25.4	49.2	54.9	0.3	5.5	21.4	74.2	7.0	
5	1.5	2.9	1.8	159.8	20.4	0.3	8.0	13.8	122.7	
6	12.1	0.4	0.4	9.3	66.7	10.1	0.0	6.1	35.3	
7	2.4	6.9	0.8	5.9	12.6	26.2	13.0	0.1	13.0	
8	2.7	2.1	1.8	1.9	2.4	4.4	31.2	2.2	6.6	
9	1.1	3.8	1.2	5.9	2.2	1.3	4.4	3.2	8.7	
10	2.1	3.2	0.3	0.8	0.5	1.0	2.1	1.5	8.8	
11+	17.2	45.6	3.5	28.0	26.8	7.9	15.1	11.6	2.8	
Total	46.2	105.9	70.3	266.3	135.8	79.8	164.3	124.7	212.7	373.8

Fortune Bay

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
3	0.6	8.4	0.0	14.3	0.0	0.0	0.0	12.1	98.8	0.6	0.3
4	0.8	6.0	22.1	2.8	224.0	0.0	0.0	0.9	1.4	54.4	3.6
5	0.6	3.9	15.0	204.5	8.8	532.2	3.1	0.9	0.0	16.8	61.3
6	0.1	3.1	6.1	69.2	69.9	11.7	420.7	15.8	0.0	2.2	11.6
7	0.2	2.4	1.4	15.7	48.3	48.3	9.8	659.3	6.2	1.7	1.3
8	6.0	2.7	4.1	4.6	10.0	20.7	50.6	14.8	236.8	21.9	1.7
9	0.3	44.0	0.3	8.8	0.8	4.8	11.4	64.9	19.7	283.8	6.3
10	0.8	4.6	4.4	6.5	2.0	1.4	2.1	33.4	59.0	38.1	70.3
11+	0.8	53.7	102.5	135.3	35.9	71.8	19.6	124.3	56.1	141.4	175.0
Total	10.3	128.7	156.0	461.6	399.3	690.2	516.8	927.3	479.4	560.9	331.4

Age	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	1.3	0.0	0.0	0.0	2.4	82.8	0.0	0.0	
4	0.0	32.1	22.6	19.0	0.0	3.7	36.7	124.2	1.2	
5	9.1	14.0	85.4	134.5	89.2	0.0	21.3	40.7	257.5	
6	140.4	21.4	8.9	112.1	193.1	514.2	15.4	8.7	54.8	
7	5.0	252.5	19.8	12.1	103.9	144.5	245.8	10.9	66.4	
8	3.7	3.3	258.4	19.0	19.6	161.6	161.3	124.2	78.1	
9	0.0	12.0	39.0	187.1	17.6	19.6	40.1	109.7	124.7	
10	9.5	12.0	12.3	19.0	104.9	28.2	21.3	55.9	117.7	
11+	245.3	319.3	237.2	360.4	451.8	350.2	230.4	251.4	464.8	
Total	413.0	668.0	683.6	862.3	980.0	1224.3	853.5	726.6	1165.0	512.8

Table 14. Biological sampling details of herring, *Valerie Amanda II*, Trip #2, White bay – Notre Dame Bay November – December, 2000

Stratum	Survey Date(s)	Sample Date	Sample Location	Gear Type	Sample #'s	n	Mean Lgt (mm)	Mean Wgt (g)
22	Nov. 28 - Dec. 3	Nov. 25	Change Islands	Comm. PS	203	50	304	231
24	Dec. 1 - 3	Nov. 16 and 29	Fogo Island	Comm. PS	202, 198	100	308	244

Table 15. Mean lengths and weights, by stratum, used to calculate target strengths for 2000 White Bay – Notre Dame Bay survey.

Stratum	Combined Samples	Mean Lgt (mm)	Mean Wgt (g)	TS / fish (dB)	TS / g
22 and 24	203,202,198	307	240	-35.76	-59.56

Table 16. White Bay – Notre Dame Bay herring biomass estimate from the 2000 acoustic survey

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
9	4.90E+07	40	0.50						
		41	0.40						
		42	1.20						
		43	1.30	1	1.110	0.0000	0.0000		
		44	0.25						
		45	0.21						
		46	0.20						
		47	0.20	2	0.705	0.0000	0.0000		
		48	1.20						
		49	0.70						
		50	1.00						
		51	1.34	3	1.384	5.9283	8.2077		
		52	0.80						
		53	0.90						
		54	0.75						
		55	0.00	4	0.800	0.0000	0.0000	2.0519	101
10	8.80E+07	56	0.10						
		57	0.10						
		58	0.10						
		70	0.10						
		59	0.15	1	0.079	0.0000	0.0000		
		61	0.10						
		60	0.41						
		62	0.75						
		71	1.00						
		63	1.37	2	0.525	0.8493	0.4455		
		64	2.53						
		65	2.15						
		66	1.85						
		72	2.07						
		67	2.99	3	1.675	0.3675	0.6155		
		68	3.05						
		69	2.78						
		73	2.60						
		74	2.74						
		75	2.20	4	1.932	2.3375	4.5162		
		76	1.93						
		77	1.68						
		78	0.80						
		79	0.60						
		80	0.45	5	0.789	0.0000	0.0000	1.1155	98
12	7.20E+07	85	0.93						
		86	1.07						
		87	1.28	1	0.879	0.4469	0.3930		
		88	1.56						
		89	2.05						
		90	0.57	2	1.121	0.0000	0.0000	0.1965	14
13	8.40E+07	91	0.39						
		92	1.05	1	0.502	0.0000	0.0000		
		93	0.46						
		94	3.84	2	1.498	1.3073	1.9587	0.9793	82

Table 16 (cont.). White Bay – Notre Dame Bay herring biomass estimate from the 2000 acoustic survey.

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
16	1.53E+08	103	0.59						
		104	1.49						
		105	2.07						
		106	2.26						
		107	2.63	1	1.419	0.0000	0.0000		
		108	1.03						
		109	0.93						
		110	1.28						
		111	1.49						
		112	1.40	2	0.962	0.0322	0.0310		
		113	1.18						
		114	1.27						
		115	1.00						
		116	0.38						
		117	0.92	3	0.745	0.0000	0.0000		
		118	0.62						
		119	0.83						
		120	1.60						
		121	0.86						
		122	0.97	4	0.766	0.0000	0.0000		
		123	1.74						
		124	0.84						
		125	1.87						
		126	1.64						
		127	0.97	5	1.108	0.0000	0.0000	0.0062	1
17	1.25E+08	128	1.10						
		129	1.20						
		130	1.10						
		131	1.50						
		132	2.40						
		133	1.50						
		134	1.20						
		135	1.00	1	1.630	0.0000	0.0000		
		136	1.10						
		137	1.10						
		138	1.50						
		139	1.50						
		140	2.40						
		141	2.10						
		142	2.20						
		143	1.80	2	2.030	0.0000	0.0000		
		144	1.90						
		145	1.90						
		146	1.30						
		147	1.75						
		148	1.75						
		149	0.20						
		150	0.25						
		151	0.30	3	1.385	0.0000	0.0000		

Table 16 (cont.). White Bay – Notre Dame Bay herring biomass estimate from the 2000 acoustic survey

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
17	1.25E+08	152	0.25						
		153	0.45						
		154	0.45						
		155	0.90						
		156	0.70						
		157	0.35						
		158	0.20						
		159	0.26	4	0.527	0.0000	0.0000		
		160	0.50						
		161	0.80						
		162	1.00						
		163	1.10						
		164	1.20						
		165	0.00						
		166	1.20						
		167	1.00	5	1.007	0.0000	0.0000		
		168	1.10						
		169	0.80						
		170	0.60						
		171	0.50						
		172	0.90						
		173	0.50						
		174	0.30						
		175	0.20	6	0.726	0.0000	0.0000		
		176	0.40						
		177	0.70						
		178	0.20						
		179	0.50						
		180	0.30						
		181	0.50						
		182	0.60						
		183	0.30	7	0.519	0.0000	0.0000		
		184	0.47						
		185	1.12						
		186	0.40						
		187	0.08						
		188	0.16						
		189	0.07						
		190	0.10						
		191	0.17	8	0.381	3.0464	1.1599		
		192	0.36						
		193	0.45						
		194	0.58						
		195	1.08						
		196	1.04						
		197	0.90						
		198	0.67						
		199	0.29	9	0.796	0.0000	0.0000	0.1289	16
								Total Biomass =	**312**
								S.E. =	**121**
								C.V. =	**0.389**

Table 17. Comparison of population numbers at age (millions) and biomass estimates (t), spring spawners only, from acoustic surveys of White Bay – Notre Dame Bay.

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991
0	623.0	0.0	0.0	0.0	14.6	0.1			
1	979.1	187.7	0.0	12.6	0.4	29.6			
2	33.0	572.2	438.6	4.3	5.1	2.2			
3	4.5	4.6	832.5	27.1	1.6	1.3			
4	81.5	3.5	9.5	212.8	24.5	0.9			
5	4.2	34.2	0.0	17.6	65.4	9.5			
6	4.2	8.0	12.9	32.0	2.0	28.9			
7	22.2	6.1	0.0	36.2	1.8	2.0			
8	0.0	15.4	0.0	0.8	4.4	4.0			
9	9.1	0.0	0.0	0.3	1.3	5.2			
10	0.0	3.2	0.0	7.5	0.8	1.1			
11+	54.3	162.8	26.1	70.7	2.9	12.3			
Total	1815.1	997.7	1319.6	421.9	124.8	97.1			
Biomass (t)	136000	78700	198400	126200	30900	22500			

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000
0	3226.3		0.0				28.6		0
1	0.0		0.0				29.0		0
2	70.7		0.0				1.9		0
3	2.1		0.4				53.0		0.1
4	7.2		4.2				34.1		0
5	191.5		0.1				0.0		0.5
6	22.5		0.1				0.0		0.3
7	10.1		2.9				1.0		0
8	9.3		0.1				1.9		0
9	16.4		0.2				0.8		0
10	57.2		0.2				0.4		0
11+	18.8		0.6				0.9		0
Total	3632.1		9.7				151.8		0.9
Biomass (t)	104500		2100				19200		230

Table 18. Biological sampling details of herring, Three T s 1, Trip #2, Fortune Bay, March 2001

Stratum	Survey Date(s)	Sample Date	Sample Location	Gear Type	Sample #'s	n	Mean Lgt (mm)	Mean Wgt (g)
84	Mar. 19 - 23	Mar. 22	Long Harbour	Res. PS	1, 2, 4, 5, 6	250	310	223

Table 19. Mean lengths and weights, by stratum, used to calculate target strengths for 2001 Fortune Bay acoustic survey.

Stratum	Combined Samples	Mean Lgt (mm)	Mean Wgt (g)	TS / fish (dB)	TS / g
84	1, 2, 4, 5, 6	310	223	-35.67	-59.16

Table 20. Fortune Bay herring biomass estimate from the 2001 herring acoustic survey

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n.mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
84	2.90E+07	108	0.00						
		109	0.20						
		110	0.55						
		111	0.70						
		112	1.08						
		113	1.17						
		114	1.26	1	1.090	0.0000	0.0000		
		115	1.31						
		116	1.22						
		117	1.50						
		118	1.35						
		119	1.35						
		120	1.04						
		121	0.20	2	1.752	0.6958	1.2188		
		122	0.33						
		123	0.76						
		124	0.55						
		125	0.45						
		126	0.51						
		127	0.52						
		128	0.63	3	0.824	100.4340	82.7753		
		129	0.65						
		130	0.68						
		131	0.56						
		132	0.56						
		133	0.51						
		134	0.47						
		135	0.10	4	0.890	0.0000	0.0000		
		136	0.14						
		137	0.38						
		138	0.40						
		139	0.40						
		140	0.28						
		141	0.24						
		142	0.18	5	0.444	1150.5062	510.7742	118.9537	3450
91	7.10E+07	315	0.20						
		316	0.30						
		317	0.33						
		318	0.37						
		319	0.40						
		320	0.39						
		321	0.37						
		322	0.35						
		323	0.37	1	0.543	0.0000	0.0000		
		324	0.30						
		325	0.37						
		326	0.40						
		327	0.49						
		328	0.56						
		329	0.51						
		330	0.54						
		331	0.52						
		332	0.50	2	0.651	0.0000	0.0000		

Table 20 (cont'). Fortune Bay herring biomass estimate from the 2001 herring acoustic survey

STRATUM	STRATUM AREA (sq. m.)	TRANSECT NUMBER	TRANSECT LENGTH (n mi.)	RANDOM SAMPLING UNIT	WEIGHTING FACTOR	MEASURED DENSITY (g/sq. m.)	WEIGHTED DENSITY (g/sq. m.)	MEAN WEIGHTED DENSITY	STRATUM BIOMASS (t)
91		333	0.52						
		334	0.60						
		335	0.58						
		336	0.60						
		337	0.68						
		338	0.71						
		339	0.53						
		340	0.51						
		341	0.39	3	0.903	0.3879	0.3504		
		342	0.43						
		343	0.95						
		344	0.95						
		345	1.00						
		346	1.10						
		347	0.74						
		348	0.86						
		349	0.80						
		350	0.80	4	1.346	0.0000	0.0000		
		351	0.75						
		352	0.80						
		353	0.88						
		354	0.99						
		355	1.00						
		356	1.20						
		357	0.98						
		358	0.94						
		359	0.70	5	1.454	0.0000	0.0000		
		360	0.61						
		361	0.42						
		362	0.46						
		363	0.23						
		364	0.00						
		365	0.57						
		366	0.64						
		367	0.90						
		368	0.9	6	0.835	0.0000	0.0000		
		369	0.9						
		370	0.82						
		371	0.92						
		372	0.80						
		373	0.50						
		374	0.76						
		375	0.67						
		376	0.74						
		377	0.87	7	1.232	0.0000	0.0000		
		378	0.82						
		379	0.88						
		380	0.90						
		381	0.90						
		382	0.74						
		383	0.85						
		384	0.72						
		385	0.83						
		391	0.80	8	1.313	0.0000	0.0000		
		392	0.76						
		393	0.80						
		394	0.80						
		395	0.51						
		396	0.53						
		397	0.70						
		398	0.00						
		399	0.00						
		400	0.00	9	0.723	0.0000	0.0000	0.0389	3
								Total Biomass =	3452
								S.E. =	1844
								C.V. =	0.535

Table 21 Comparison of population numbers at age (millions) and biomass estimates (t) spring spawners only from acoustic surveys of Fortune Bay

Age	1986	1987	1988	1989	1990	1991	1992	1993
0	0.0				0.0		0.0	
1	0.0				0.0		0.2	
2	0.0				0.0		5.1	
3	0.0				22.4		0.1	
4	18.4				2.2		0.7	
5	0.6				0.3		9.2	
6	2.1				0.3		0.7	
7	1.8				7.3		0.0	
8	0.9				19.3		0.4	
9	0.6				0.8		5.6	
10	1.5				0.8		22.8	
11+	3.5				2.2		13.0	
Total	29.4				55.6		57.8	
Biomass (t)	9100				14400		18400	

Age	1994	1995	1996	1997	1998	1999	2000	2001
0		0.0		0.0		0.0		
1		0.6		0.0		0.0		
2		0.0		0.0		0.0		
3		14.2		1.3		161.3		
4		1.9		1.1		5.4		
5		4.4		47.2		2.4		8.1
6		0.0		9.3		1.1		0.7
7		0.0		6.7		23.7		0.2
8		0.0		0.2		4.6		1.2
9		0.0		0.8		1.7		1.8
10		0.0		1.1		0.8		0.5
11+		0.3		5.3		10.0		2
Total		21.4		72.9		211.1		14.6
Biomass (t)		2500		15500		30000		3215

Table 22. Parameters, catch rates and abundance indices by stock area and year from commercial gill net logbook data.

Stock Area	Year	Number of Fishers	Mean Age of Fishers	Fishing Dates Start	Fishing Dates End	Total Nets Fished	Total Nights Fished	Mean Mesh Size (mm)	Mean Panel Size (sq m)	Total Logbook Catch (t)	Total Comm Catch (t)	Catch / Std Net / Night Fished (kg)	Current Year Abundance Index	Previous Year Abundance Index	Current Year Spawning Index
WBNDB	1981	8		01-Apr	23-May	110	60			50.5	2855	68.5			
	1983	38		18-Apr	14-Jul	78	1017			68.0	406	41.8			
	1996	16		01-Apr	18-Jun	108	440	64.7	299	68.5	229	38.4		5.75	
	1997	9	45.3	10-May	30-Jun	35	265	63.8	205	9.2	20	36.7	5.00	5.85	7.00
	1998	13	46.7	15-Apr	30-Jun	49	486	62.6	237	8.7	31	14.9	3.00	3.33	3.91
	1999	5	38.2	20-Apr	30-Jun	24	214	63.3	363	9.7	34	17.3	5.83	3.67	3.80
	2000	8	47.1	15-Apr	10-Jul	19	306	63.4	310	6.8	19	22.5	2.69	3.93	3.55
	2001	10	45.1	05-May	12-Jul	28	325	60.8	201	8.2	4	25.3	4.60	2.83	4.42
	2002	6	48.5	30-Apr	21-Jun	14	188	60.6	263	2.7		1.3	2.33		1.00
BBTB	1981	10		02-Apr	04-May	89	145			33.0	1766	25.9			
	1983	18		18-Apr	25-Jun	30	494			11.5	69	15.5			
	1996	11		02-Apr	05-Jun	94	252	65.3	214	51.5	378	52.6		6.17	
	1997	6	45.0	07-Apr	27-Jun	38	287	66.1	312	39.4	201	27.9	8.00	5.80	8.33
	1998	6	45.0	02-Apr	21-Jun	52	191	66.0	245	16.3	170	13.5	5.00	6.00	7.33
	1999	5	51.0	02-Apr	29-Jun	19	173	66.0	330	28.7	195	27.8	6.00	3.70	3.50
	2000	9	48.7	08-Apr	30-Jun	29	316	65.3	349	23.6	202	36.7	4.27	4.45	3.71
	2001	10	46.3	13-Apr	30-Jun	27	357	66.3	298	22.3	56	33.2	3.82	2.17	3.60
	2002	7	51.8	20-Apr	21-Jun	14	227	66.4	320	1.2		5.5	1.40		2.00
SMBPB	1983	6		18-Apr	29-Jun	10	192			1.2	40	3.4			
	1996	13		19-Mar	15-Jun	54	499	67.1	261	45.3	38	31.4		5.50	
	1997	6	50.3	12-Feb	24-Jun	39	334	68.3	265	15.4	20	20.7	3.50	3.29	4.50
	1998	8	52.4	17-Mar	25-Jun	41	1046	68.2	257	25.9	19	20.2	2.57	3.38	4.83
	1999	6	51.0	21-Feb	29-May	31	577	65.6	319	11.9	1	12.0	2.75	4.50	1.83
	2000	1	56.5	01-Apr	26-May	5	56	66.7	334	2.7	0	10.1	4.00	2.80	2.00
	2001	3	51.6	28-Apr	23-Jun	8	88	65.3	226	2.0	39	10.0	3.00	3.00	3.25
	2002	3	56.3	20-Feb	08-Jun	10	180	65.8	263	13.8		22.9	3.67		4.00
FB	1996	11		08-Apr	10-Jun	40	837	68.6	304	60	30	37.5		7.33	
	1997	13	49.8	29-Mar	28-Jun	57	1350	66.9	271	68.9	28	39.4	7.60	6.55	8.43
	1998	11	49.3	01-Apr	17-Jun	34	898	65.2	218	41.3	1	54.7	7.40	8.36	7.22
	1999	8	49.0	21-Mar	15-Jun	23	498	65.8	313	36.1	29	37.9	8.14	8.10	7.14
	2000	11	49.8	25-Mar	12-Jun	28	618	68.3	274	81.3	16	74.0	8.45	7.63	8.09
	2001	8	53.8	28-Mar	21-Jun	20	667	65.6	311	54.6	0	38.2	6.75	7.40	6.00
	2002	5	54.0	28-Mar	29-Jun	11	353	65.5	302	31.4		56.7	7.20		7.00

Table 23. Number of herring purse seine fishers who participated in the fishery and number of respondants to the questionnaire, by year, bay, and stock area.

	1996			1997			1998			1999			2000			2001			2002		
Area	Fished	Respond	%	Fished	Respond	%	Fished	Respond	%	Fished	Respond	%	Fished	Respond	%	Fished	Respond	%	Fished	Respond	%
WB	7	7	100	2	2	100	2	2	100	2	2	100	6	4	67	0	0		-	-	-
NDB	11	10	91	13	12	92	4	4	100	5	5	100	6	5	83	0	0		-	-	-
WB-NDB	18	17	94	15	14	93	6	6	100	7	7	100	12	9	75	0	0		-	-	-
BB	13	13	100	8	7	88	7	6	86	8	8	100	6	5	83	4	4	100	-	-	-
TB	8	8	100	8	8	100	6	5	83	6	6	100	1	0	0	1	0	0	-	-	-
BB-TB	21	21	100	16	15	94	13	11	85	14	14	100	7	5	71	5	4	80	-	-	-
SMB	5	4	80	5	5	100	6	5	83	0	0		0	0		1	1	100	1	1	100
PB	5	5	100	10	10	100	9	8	89	3	2	67	1	1	100	1	1	100	4	4	100
SMB-PB	10	9	90	15	15	100	15	13	87	3	2	67	1	1	100	2	2	100	5	5	100
Overall	49	47	96	46	44	96	34	30	88	24	23	96	20	15	75	7	6	86	5	5	100

Table 24. Herring purse seine fleet characteristics, average vessel length (ft.), average vessel capacity (lbs.), average seine lengths and depths (fathoms), by year and stock area.

Area	Parameter	1996	1997	1998	1999	2000	2001	2002
WB-NDB	Vessel Length	54.3	51.6	50.5	47.8	52.3	-	-
	Vessel Capacity	91353	70867	67500	82000	85000	-	-
	Seine Length	150	149	145	146	147	-	-
	Seine Depth	23	22	24	21	22	-	-
BB-TB	Vessel Length	46.2	45.5	43.1	45.4	44.8	46	-
	Vessel Capacity	58095	56133	48364	59124	70000	68750	-
	Seine Length	150	141	137	136	137	140	-
	Seine Depth	24	22	22	23	23	24	-
SMB-PB	Vessel Length	49.9	50.1	50.6	43.5	42.0	48.7	43.6
	Vessel Capacity	74556	69800	64923	37500	38000	46667	45800
	Seine Length	189	198	194	163	165	175	157
	Seine Depth	33	32	30	30	25	33	27

Table 25 Landings, discards, and total removals (landings plus dead discards) by stock area and year (all amounts are in metric tons).

Area	Parameter	1996	1997	1998	1999	2000	2001	2002
WB-NDB	Total Landings (questionnaire)	391.9	1800.5	301.9	882.4	651.0	-	-
	Total Landings (Statistics)	435.0	2375.0	606.0	1011.0	1071.0	13.0	
	Discarded at Sea	445.5	2045.0	540.0	115.8	130.0	-	-
	Survival of Discards (%)	48.8	96.8	93.3	39.4	100.0	-	-
	Total Removals	620.0	1865.6	338.4	952.8	651.0	-	-
	Ratio (Removals : Landings)	1.58	1.04	1.12	1.08	1.00	-	-
	Effort (Sets / Fisher)	1.5	21.0	18.0	10.0	2.4	-	-
BB-TB	Total Landings (questionnaire)	737.5	736.0	621.0	893.5	344.0	259.5	-
	Total Landings (Statistics)	358.0	650.0	661.0	809.0	495.0	259.0	
	Discarded at Sea	209.0	47.0	8.5	219.0	264.0	2030.0	-
	Survival of Discards (%)	50.0	59.8	50.0	68.8	94.8	82.5	-
	Total Removals	842.0	754.9	625.3	961.8	357.7	614.8	-
	Ratio (Removals : Landings)	1.14	1.03	1.01	1.08	1.04	2.37	-
	Effort (Sets / Fisher)	4.4	9.1	10.1	8.8	14.6	31.5	-
SMB-PB	Total Landings (questionnaire)	459.5	4400.9	1726.9	186.0	400.0	429.5	690.0
	Total Landings (Statistics)	446.0	3836.0	2310.0	330.0	0.0	451.0	-
	Discarded at Sea	225.0	403.0	790.0	0.0	105.0	100.0	150.0
	Survival of Discards (%)	50.0	81.9	98.8	-	90.0	95.0	97.5
	Total Removals	572.0	4474.0	1736.1	186.0	410.5	434.5	693.8
	Ratio (Removals : Landings)	1.24	1.02	1.01	1.00	1.03	1.01	1.01
	Effort (Sets / Fisher)	1.8	21.1	10.8	13.0	24.0	5.5	6.2

Table 26 White Bay – Notre Dame Bay performance table to the spring of 2002

The Fishery	Observation		
Reported Landings	Landings decreased from 1090 t in 2000 to 22 t in 2001. 2% of the TAC was taken in 2001. average landings of 2800 t during 1990's; peak landings of 15,700 t in 1979. To June 30, 2002 the catch was 17 t		
Total Removals	In addition to reported landings in 2001, an unknown amount of herring (considered to be less than 500 t) was caught in the gillnet bait fishery.		
Effort	Effort was less in the 1990's than in the 1980's and has continued to decline; purse seine effort decreased by 88% from 1997 to 2000 and there was no fishery in 2001; gillnet effort has also decreased by 86% from 1996 to 2002		
Geographic Distribution of Fishery	There was no purse seine fishery in 2001. The 2002 gillnet fishery, from early May to mid June, was mostly in eastern Notre Dame Bay.		
Abundance Indices	**Observation**	**Interpretation**	**Evaluation**
Research Gillnet Catch Rates	Decreased from 2001 to 2002; lowest in 15 year time series; decreasing trend since 1992.	Current abundance very low and decreasing	–
Acoustic Biomass Estimates	2000 survey estimate was lowest in time series; decreasing trend in 10 surveys since 1983.	Abundance in 2000 very low, much lower than in the 1980's. More recent data not available, therefore, no evaluation	
Commercial Gillnet Catch Rates	Large decrease from 2001 to 2002; lowest in 7 year time series; decreasing trend in time series	Current abundance very low and decreasing	–
Gillnet Fisher Observations	Abundance in 2002 perceived to be below average and declining.	Current abundance low and decreasing	
Purse Seine Fisher Observations	Abundance in 2000 perceived to be above average and stable.	Abundance in 2000 stable and no cause for concern. No information since 2000 therefore no evaluation	
Recruitment (year classes since 1998)	Most observations indicate weak incoming year classes; no abundance estimates are available	Poor recruitment	–
Biological Characteristics	**Observation**	**Interpretation**	**Evaluation**
2001 Age Compositions (ages 4+)	Dominated by two age groups (1995 and 1997 year classes); very few younger or older fish	Truncated age composition	–
Weight at Age	Weights at most ages have decreased continuously since the early 1980's.	Potential increase in fishing mortality per tonne caught	?
Length and Age at Maturity	Currently maturing at smaller lengths than in the early 1980's; no change in age at maturity	Reduction in number of eggs deposited due to lower fecundity	?
Ecological Considerations	**Observation**	**Interpretation**	**Evaluation**
Predation	Proportion of herring in harp seal diet has increased in near shore areas since the 1980's; no other predation data available.	Increased mortality by harp seals, other changes in predation mortality unknown	?
Water Temperature (at 10 m in Comfort Cove, NDB)	Mean annual temperature decreased from 5°C in 1990 to 3°C in 1992; increased gradually to 6°C in 1999.	May have reduced herring growth rates in the 1990's; lower temperatures may also adversely affect recruitment.	?
Water Salinity (at Station 27, off St. John's)	Mean annual salinities decreased from 1990 to 1991 and have remained at levels lower than in the 1980's.	Lower salinities may adversely affect recruitment.	?

STOCK STATUS	**Interpretation**	**Evaluation**
Current	Current abundance is low, possibly lowest in 20 years; few age groups in the population.	–
Prospect	Current mature year classes considered to be weak; most evidence suggests that recruitment is poor.	–

Most available data indicate that this stock is at a very low level, possibly the lowest since it was closed to fishing in the early 1980's. Overall prospects are negative due to poor recruitment. The status has not changed since the last assessment in 2000, when it was classified as very poor.

–	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

Table 27. Bonavista Bay – Trinity Bay performance table to the spring of 2002

The Fishery	Observation
Reported Landings	Landings decreased from 1090 t in 2000 to 490 t in 2001; 14% of the TAC was taken in 2001; average landings of 2600 t during 1990's; peak landings of 12,000 t in 1977. To June 30, 2002 the catch was 391 t.
Total Removals	In addition to reported landings in 2001, an unknown amount of herring (considered to be less than 300 t) was caught in the gill net bait fishery; mortality from discards in the purse seine fishery, due entirely to small fish, was reported to be approximately 350 t.
Effort	Overall, effort was less in the 1990's than in the 1980's; gillnet effort has continued to decline, by 79% since 1996; purse seine effort increased since 1996 and was highest in 2001.
Geographic Distribution of Fishery	The 2001 purse seine fishery, in October and November, was concentrated in the northern part of Bonavista Bay. The 2002 gillnet fishery, from mid April to mid June, was distributed throughout Bonavista and Trinity Bays.

Abundance Indices	Observation	Interpretation	Evaluation
Research Gillnet Catch Rates	Decreased from 2000 to 2002; lowest in 15 year time series; decreasing trend since 1992.	Current abundance very low and decreasing.	-
Acoustic Biomass Estimates	Decreasing trend in 10 surveys since 1984.	Abundance in 1999 low, much lower than in the 1980's. More recent information not available therefore no evaluation.	
Commercial Gillnet Catch Rates	Large decrease from 2001 to 2002; lowest in 7 year time series; 2002 = 6, mean = 28, maximum = 53.	Current abundance very low and decreasing.	-
Gillnet Fisher Observations	Abundance in 2002 perceived to be below average and declining.	Current abundance low and decreasing.	-
Purse Seine Fisher Observations	Abundance in 2001 perceived to be above average and increasing.	Current abundance increasing and no cause for concern.	+
Recruitment (year classes since 1998)	1998 and 1999 year classes detected in purse seine fishery and acoustic survey; however, no estimates are available.	Some evidence of recruitment, not quantified.	?

Biological Characteristics	Observation	Interpretation	Evaluation
2001 Age Compositions (ages 4+)	Dominated by the 1995 year class; younger or older fish well represented.	Spawning biomass consists of a broad age composition.	+
Weight at Age	Weights at most ages have decreased continuously since the early 1980's.	Potential increase in fishing mortality per tonne caught.	?
Length and Age at Maturity	Currently maturing at smaller lengths than in the early 1980's; no change in age at maturity.	Reduction in number of eggs deposited due to lower fecundity.	?

Ecological Considerations	Observation	Interpretation	Evaluation
Predation	Proportion of herring in harp seal diet has increased in near shore areas since the 1980's; no other predation data available.	Increased mortality by harp seals; other changes in predation mortality unknown.	?
Water Temperature (at 10 m in Stock Cove, BB)	Mean annual temperature decreased from 5.5°C in 1990 to 3.5°C in 1992; increased gradually to 4.5°C in 2000.	May have reduced herring growth rates in the 1990's; lower temperatures may also adversely affect recruitment.	?
Water Salinity (at Station 27, off St. John's)	Mean annual salinities decreased from 1990 to 1991 and have remained at levels lower than in the 1980's.	Lower salinities may adversely affect recruitment.	?

STOCK STATUS	Interpretation	Evaluation
Current	Population age structure is considered to be stable; however, current abundance is low, possibly lowest in 20 years.	-
Prospect	Current mature year classes considered to be weak; recruitment evident but unquantified.	?

Most available data indicate that this stock is at a low level. Future prospects depend upon recruitment of year classes since 1998, which are not yet quantified. Due to substantial decreases in commercial and research gillnet catch rates, stock status has changed since the last assessment in 2000, when it was classified as good.

-	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

Table 28. St. Mary's Bay – Placentia Bay performance report to the spring of 2002.

The Fishery	Observation		
Reported Landings	Landings in 2000 and 2001 were the same: 500 t. 25% of the TAC was taken in 2001; average landings of 1200 t during 1990's; peak landings of 4000 t in 1997 (since large mobile purse seine fishery in 1960's). To June 30, 2002 the catch was 1120 t, over double the catch in all of 2001.		
Total Removals	In addition to reported landings in 2001, an unknown amount of herring (considered to be less than 150 t) was caught in the gillnet bait fishery; there was minimal reported discard mortality in the purse seine fishery.		
Effort	Effort increased from the 1980's to the 1990's; purse seine effort peaked in 1997 and has since declined by 71%; gillnet effort peaked in 1998 and has since declined by 89%.		
Geographic Distribution of Fishery	The purse seine fishery, in March 2002, was concentrated along the eastern side of Placentia Bay. The 2002 gillnet fishery, from mid February to early June, was mostly in Placentia Bay.		
Abundance Indices	**Observation**	**Interpretation**	**Evaluation**
Research Gillnet Catch Rates	Increased from 2001 to 2002; highest in 21 year time series; increasing trend since 2000.	Recent increase in abundance.	+
Acoustic Biomass Estimates	2000 estimate was lowest in time series; decreasing trend in 10 surveys since 1984.	Abundance in 2000 low, much lower than in the 1980's; more recent information not available; therefore no evaluation.	
Commercial Gillnet Catch Rates	Stable at low level from 1999 to 2001; increased from 2001 to 2002 to second highest in 7 year series.	Recent increase in abundance.	+
Gillnet Fisher Observations	Abundance in 2002 perceived to be below average and stable or increasing marginally.	Current abundance low and stable or increasing marginally.	
Purse Seine Fisher Observations	Abundance in 2002 perceived to be above average and increasing.	Current abundance increasing and no cause for concern.	+
Recruitment (year classes since 1998)	1998 year class detected in research gill net catches; initially estimated to be weak.	Possibly poor recruitment.	?
Biological Characteristics	**Observation**	**Interpretation**	**Evaluation**
2001 Age Compositions (ages 4+)	Dominated by the 1996 year class; representation of older fish, but few younger fish.	Fairly Broad population age structure. But concern regarding apparent lack of younger fish.	?
Weight at Age	Weights at most ages have decreased continuously since the early 1980's.	Potential increase in fishing mortality.	?
Length and Age at Maturity	Currently maturing at smaller lengths than in the early 1980's.	Reduction in number of eggs deposited due to lower fecundity.	?
Ecological Considerations	**Observation**	**Interpretation**	**Evaluation**
Predation	No predation data available.		
Water Temperature (at 10 m in Arnold's Cove, PB)	Mean annual temperature decreased from 6.5°C in 1990 to 5.0°C in 1992; increased gradually to 7°C in 2000.	May have reduced growth rates in the 1990's; lower temperatures may also adversely affect recruitment.	?
Water Salinity (at Station 27, off St. John's)	Mean annual salinities decreased from 1990 to 1991 and have remained at levels lower than in the 1980's.	Lower salinities may adversely affect recruitment.	?

STOCK STATUS	Interpretation	Evaluation
Current	Current abundance is increasing; population age structure is considered to be moderately stable.	+
Prospect	One dominant year class considered to be moderate, at best; other mature year classes considered weak; unquantified recruitment.	?

Most available data indicate that this stock is increasing due to one year class (1996). Prospects are questionable due to potential poor recruitment of year classes since 1998. Stock status has not changed since the last assessment in 2000, when it was classified as moderate to good.

	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

Table 29. Fortune Bay performance table to the spring of 2002.

The Fishery	Observation		
Reported Landings	Landings increased from 850 t in 2000 to 1300 t in 2001. 47% of the TAC was taken in 2001; average landings of 200 t during 1990's; peak landings in 2001 (since large mobile purse seine fishery in 1960's). To June 30, 2002 the catch was 2711 t, over double the catch in all of 2001.		
Total Removals	In addition to reported landings in 2001, an unknown amount of herring (considered to be less than 400 t) was caught in the gillnet bait fishery.		
Geographic Distribution of Fishery	Effort in 1980's and 1990's was very low; gillnet effort peaked in 1997 and has since declined by 87%; there is no purse seine fishery in Fortune Bay; the current fishery is primarily by bar seine for which no effort information is available.		
Exploitation Pattern	The 2002 spring bar seine fishery was concentrated in the Long Harbour area; the gillnet fishery, from early April to late June, was distributed throughout Fortune Bay.		
Abundance Indices	**Observation**	**Interpretation**	**Evaluation**
Research Gillnet Catch Rates	Decreased from 2001 to 2002; catch rates below average but still very high.	Recent decrease in abundance but still at a high level, relative to other stocks.	+
Acoustic Biomass Estimates	2001 estimate second lowest of 7 surveys since 1986; increasing trend until 1999.	Abundance in 2001 lower than in previous surveys and second lowest in series.	-
Commercial Gillnet Catch Rates	No trend; catch rates have fluctuated at high levels for several years.	Current abundance stable at a high level.	+
Gillnet Fisher Observations	Abundance in 2002 perceived to be above average and stable or decreasing marginally.	Current abundance high and stable or decreasing marginally.	+
Recruitment (year classes since 1998)	1998 and 1999 year classes detected in commercial bar seine catches, however, no estimates are available for these year classes.	Minimal evidence of recruitment; not quantified.	?
Biological Characteristics	**Observation**	**Interpretation**	**Evaluation**
2001 Age Compositions (ages 4+)	Dominated by one age group (1996 year class); fish aged 11+ very well represented.	Population age structure is considered to be stable due to substantial contribution of older fish.	+
Weight at Age	Weights at most ages have decreased continuously since the early 1980's.	Potential increase in fishing mortality per tonne caught.	?
Length and Age at Maturity	Currently maturing at smaller lengths than in the early 1980's; age at maturity is older.	Reduction in number of eggs deposited due to lower fecundity.	?
Ecological Considerations	**Observation**	**Interpretation**	**Evaluation**
Predation	No predation data available.		
Water Temperature (at 10 m in Arnold's Cove, PB)	Mean annual temperature decreased from 6.5°C in 1990 to 5.0°C in 1992; increased gradually to 7°C in 2000.	May have reduced herring growth rates in the 1990's; lower temperatures may also adversely affect recruitment.	?
Water Salinity (at Station 27, off St. John's)	Mean annual salinities decreased from 1990 to 1991 and have remained at levels lower than in the 1980's.	Lower salinities may adversely affect recruitment.	?

STOCK STATUS	Interpretation	Evaluation
Current	Current abundance due to one year class is at a high level relative to the 1980's; population age structure is considered to be stable.	+
Prospect	One dominant year class considered to be moderate, at best; other mature year classes considered weak; unquantified recruitment.	?

All available data indicate that this stock is at a high level due to low fishing mortality over the past fifteen years. Prospects are questionable due to potential poor recruitment of year classes since 1998. Stock status has not changed since the last assessment in 2000, when it was classified as moderate to good.

-	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

Table 30. Commercial purse seine effort (sets/fisher) calculated from purse seine questionnaire data.

Stock Area	Year	# of Fishers	# of Sets	Sets / Fisher
WB-NDB	1996	17	26	1.5
	1997	14	294	21.0
	1998	6	108	18.0
	1999	7	70	10.0
	2000	12	29	2.4
	2001	0	0	0.0
BB-TB	1996	21	93	4.4
	1997	15	136	9.1
	1998	11	111	10.1
	1999	14	123	8.8
	2000	5	73	14.6
	2001	4	126	31.5
SMB-PB	1996	9	16	1.8
	1997	15	316	21.1
	1998	13	141	10.8
	1999	2	26	13.0
	2000	1	24	24.0
	2001	2	11	5.5
	2002	5	31	6.2

Table 31. Commercial gill net effort (net nights per fisher) calculated from logbook data.

Stock Area	Year	# of Fishers	# of Nets Fished	# of Nights Fished	Net Nights / Fisher
WB-NDB	1996	16	108	440	2970
	1997	9	35	265	1031
	1998	13	49	486	1832
	1999	5	24	214	1027
	2000	8	19	306	727
	2001	10	28	325	910
	2002	6	14	188	439
BB-TB	1996	11	94	252	2153
	1997	6	38	287	1818
	1998	6	52	191	1655
	1999	5	19	173	657
	2000	9	29	316	1018
	2001	10	27	357	964
	2002	7	14	227	454
SMB-PB	1996	13	54	499	2073
	1997	6	39	334	2171
	1998	8	41	1046	5361
	1999	6	31	577	2981
	2000	1	5	56	280
	2001	3	8	88	235
	2002	3	10	180	600
FB	1996	11	40	837	3044
	1997	13	57	1350	5919
	1998	11	34	898	2776
	1999	8	23	498	1432
	2000	11	28	618	1573
	2001	8	20	667	1668
	2002	5	11	353	777

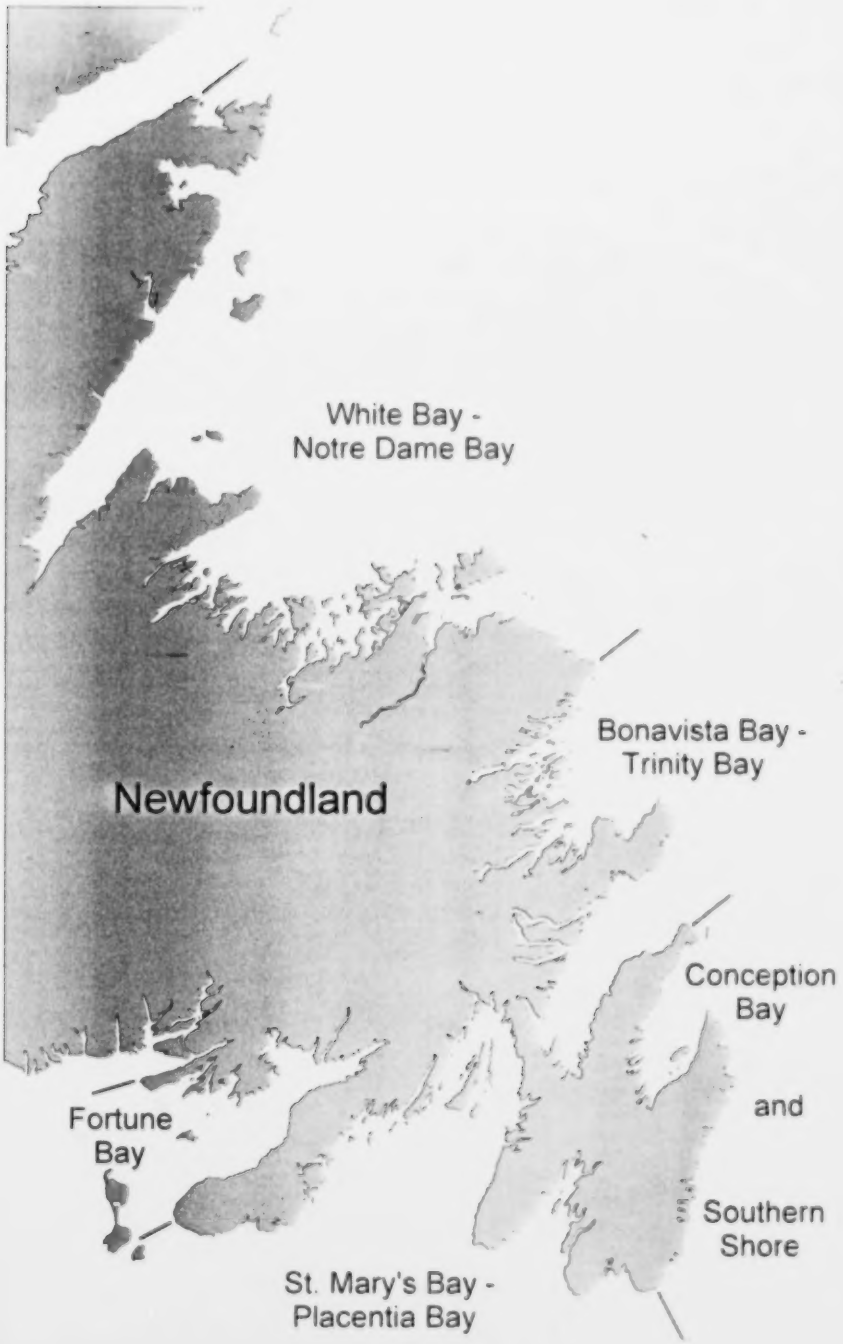

Figure 1. Area map indicating herring stock complexes within the Newfoundland Region.

Figure 1. Area map indicating herring stock complexes within the Newfoundland Region.

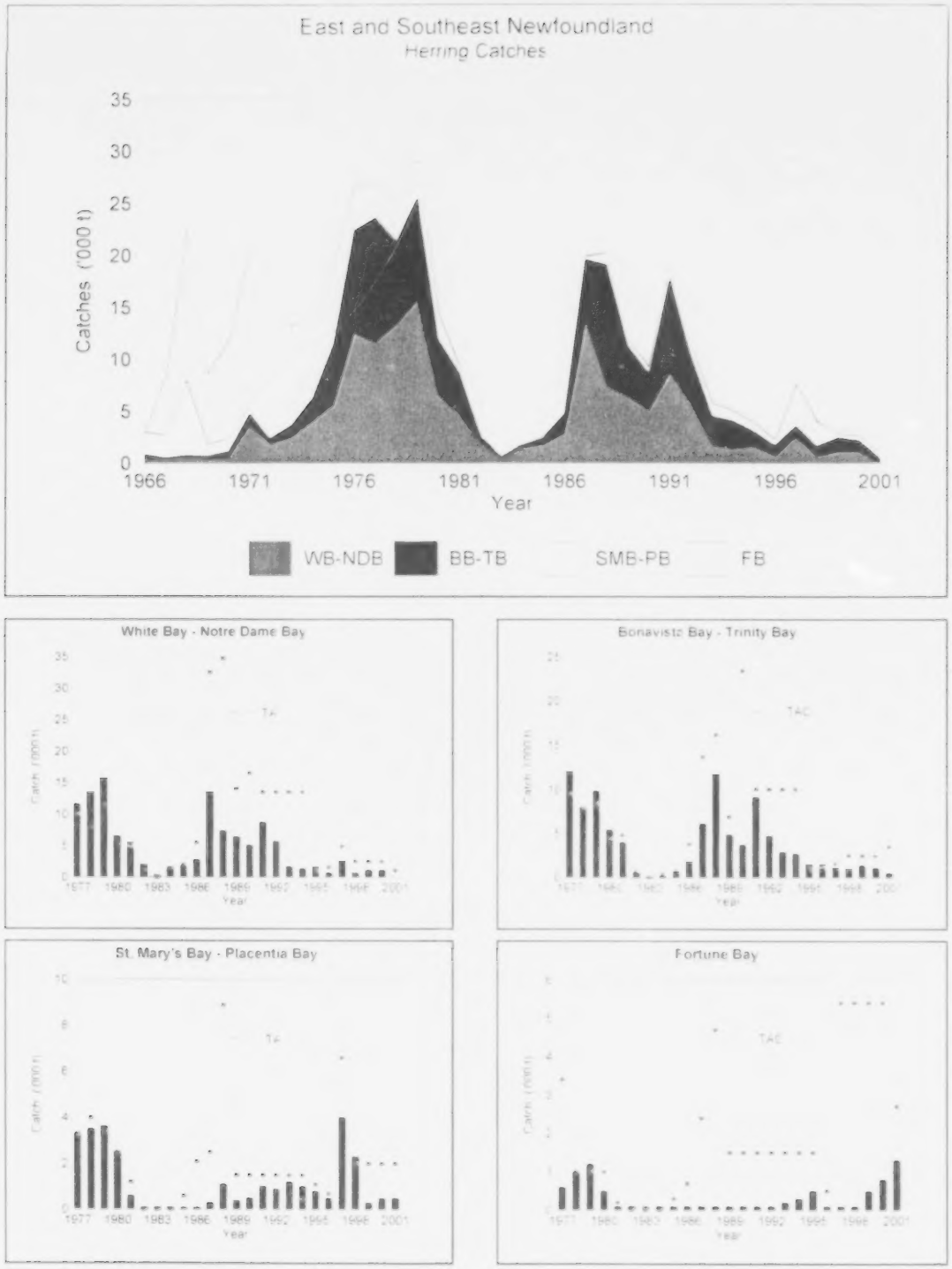

Figure 2. East and southeast Newfoundland herring catches and TAC's, by stock area.

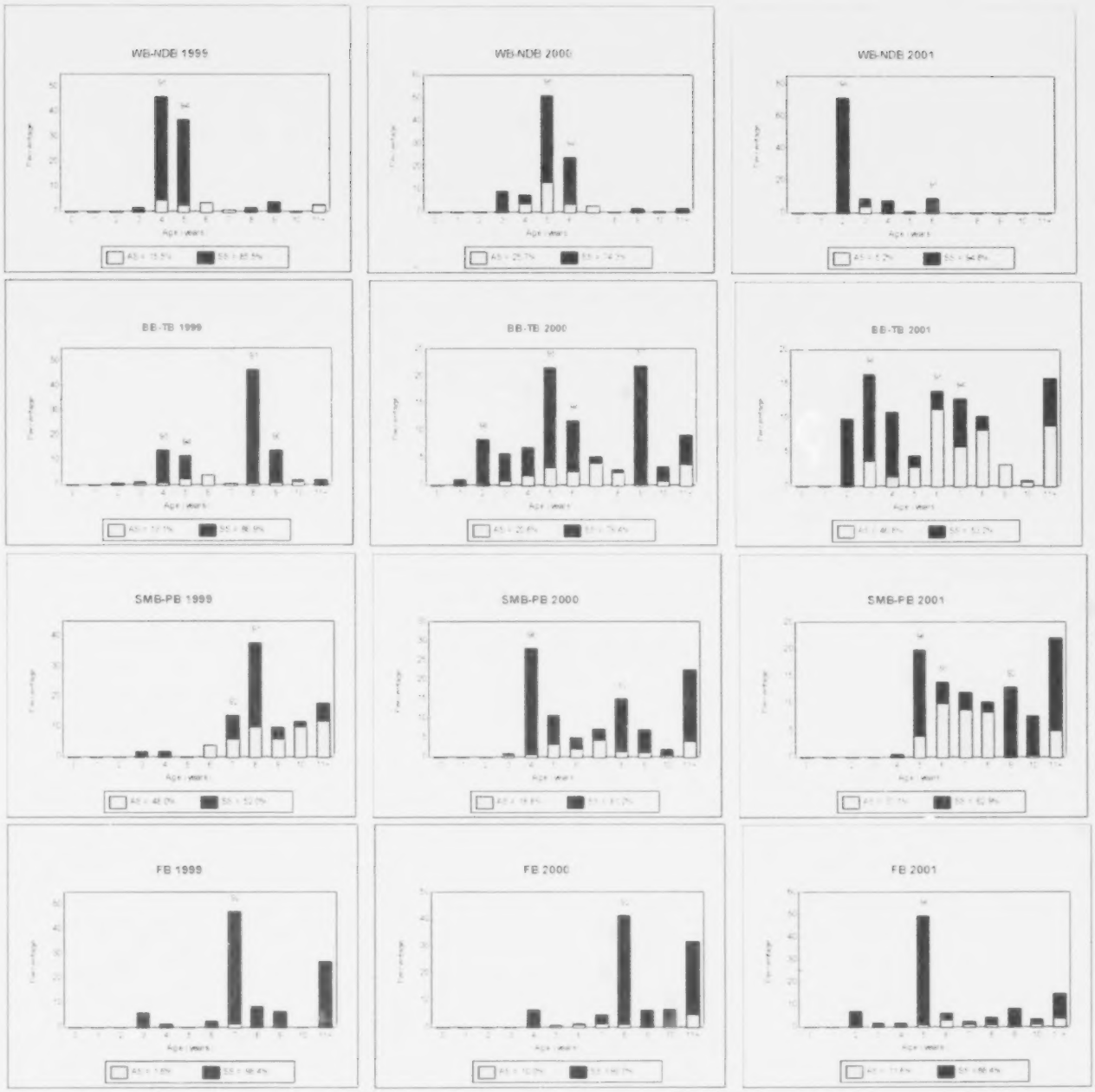

Figure 3. Age distribution of herring from the commercial fishery, White Bay – Notre Dame Bay, Bonavista Bay – Trinity Bay, St. Mary's Bay – Placentia Bay, and Fortune Bay, 1999 – 2001.

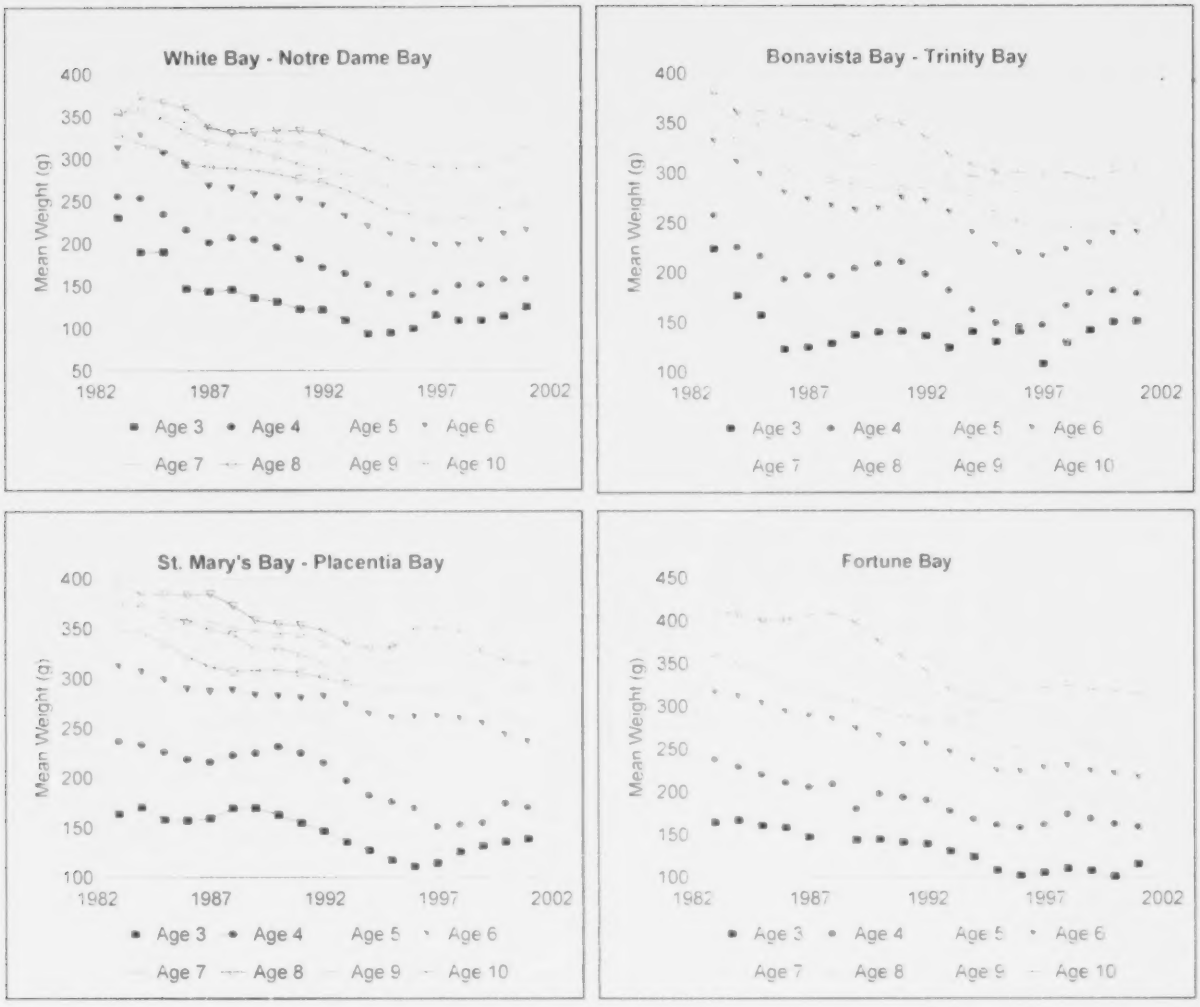

Figure 4. Mean weights at age (three year moving average) of spring spawning herring, by stock area and year, from samples collected January to June.

Figure 5. East and southeast Newfoundland herring research gill net locations.

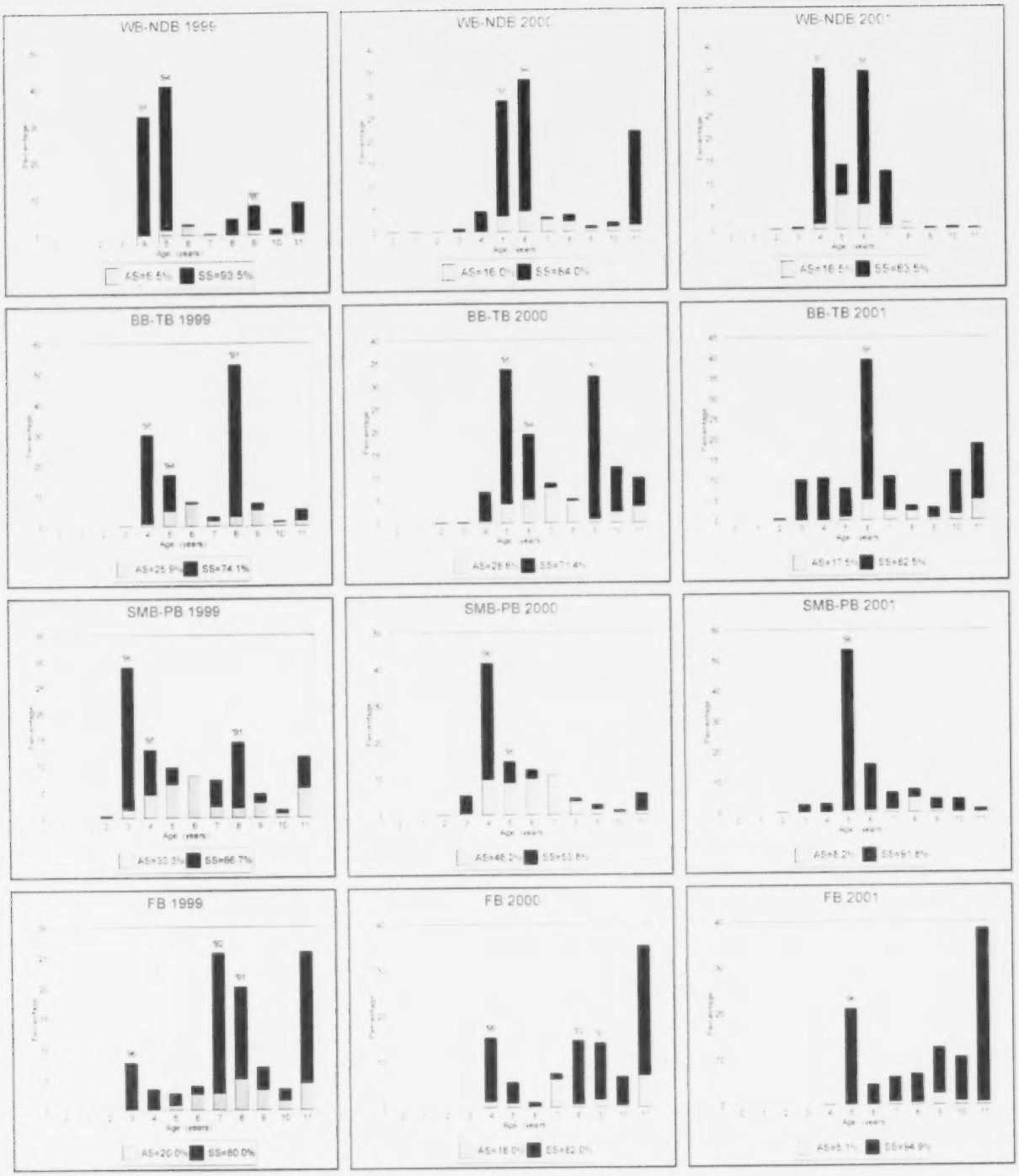

Figure 6. Age distribution (by number) of herring from the spring research gill net program, by stock area, 1999 – 2001.

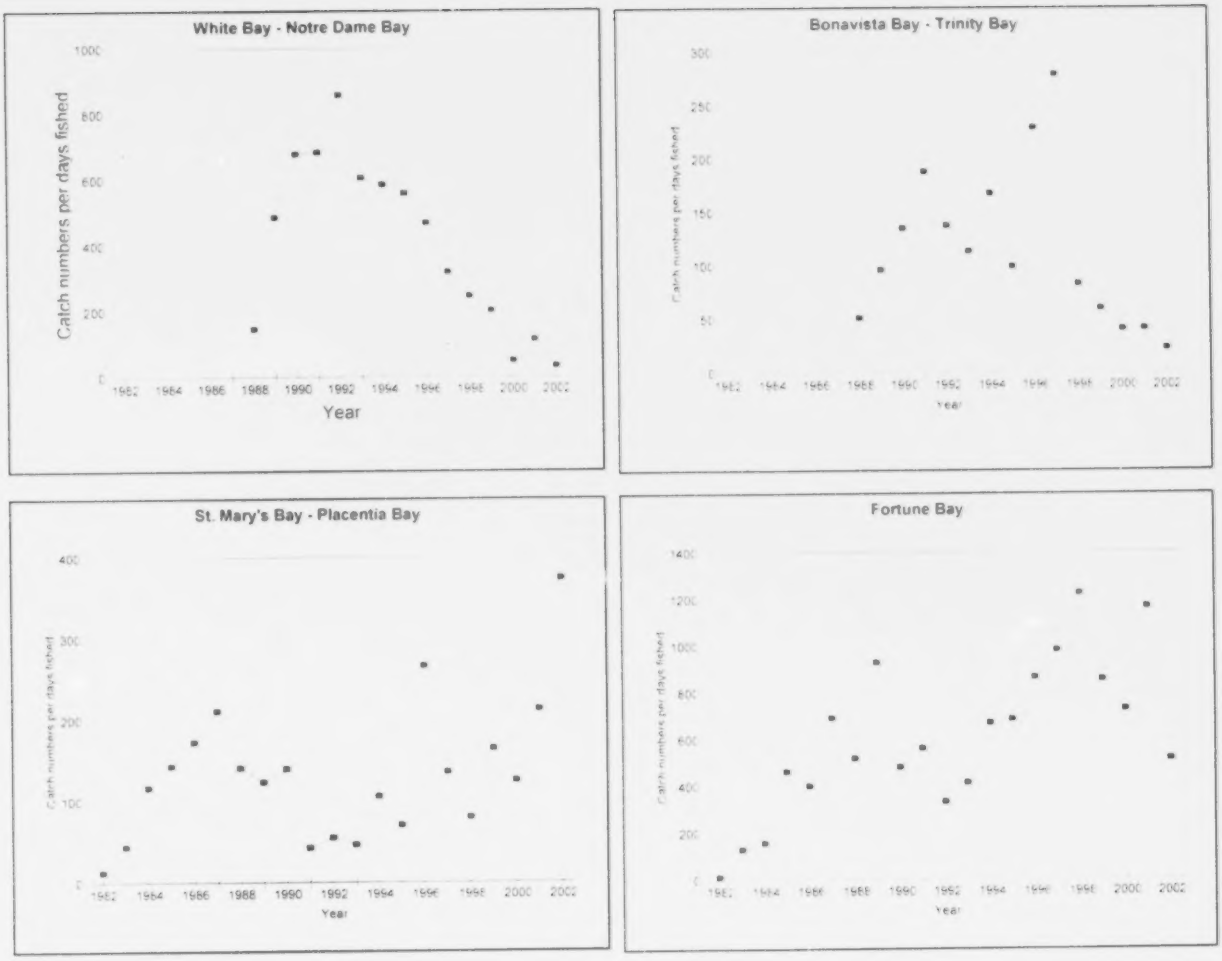
White Bay - Notre Dame Bay
Catch numbers per days fished
Year
Bonavista Bay - Trinity Bay
St. Mary's Bay - Placentia Bay
Fortune Bay

Figure 7. Spring research gill net catch rates (numbers per days fished), spring spawners only, by stock area and year.

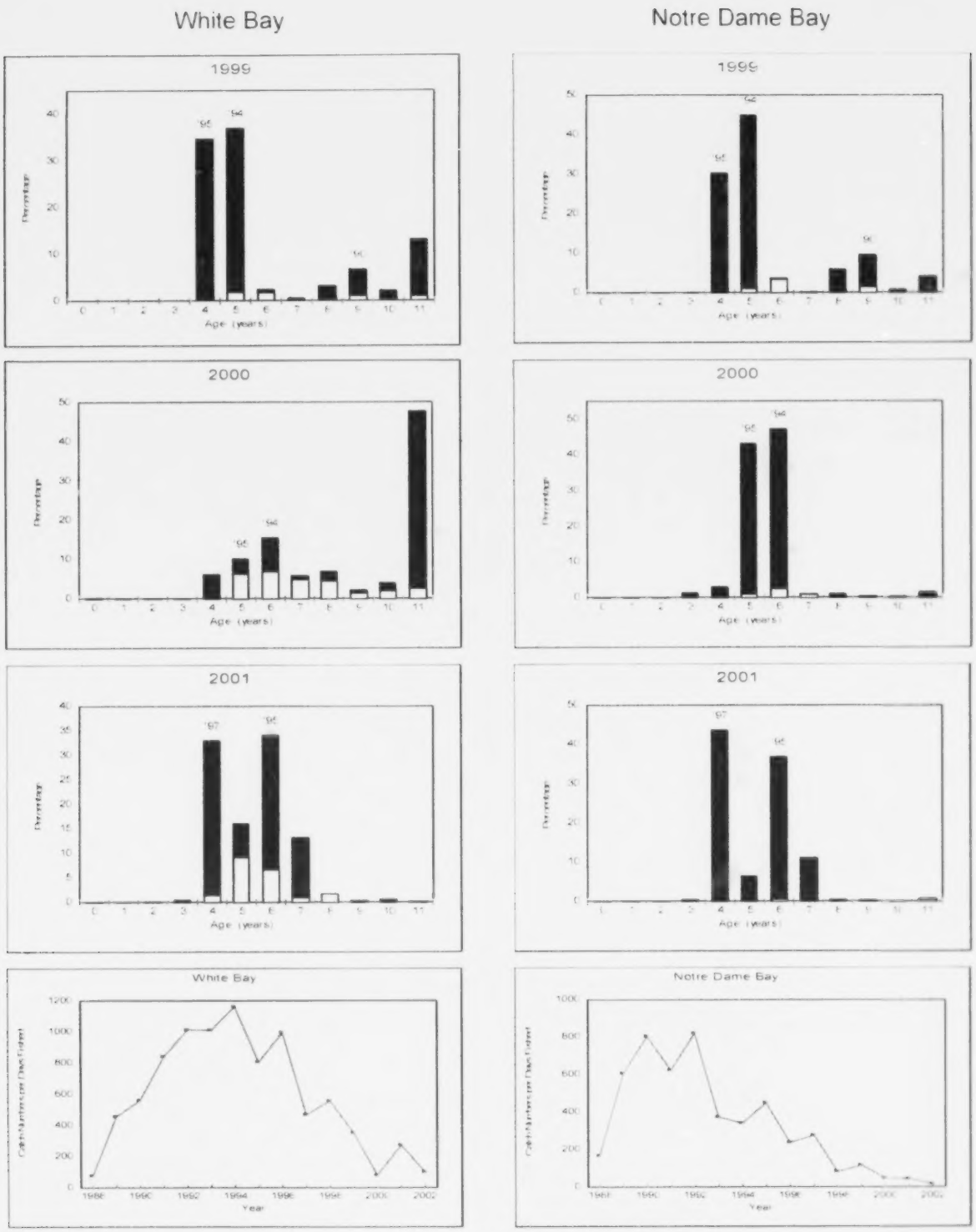

Figure 8. Herring age distributions (by number), 1999 – 2001, and catch rates (numbers per days fished), 1988 – 2002, from the spring research gill net program for WB-NDB separately.

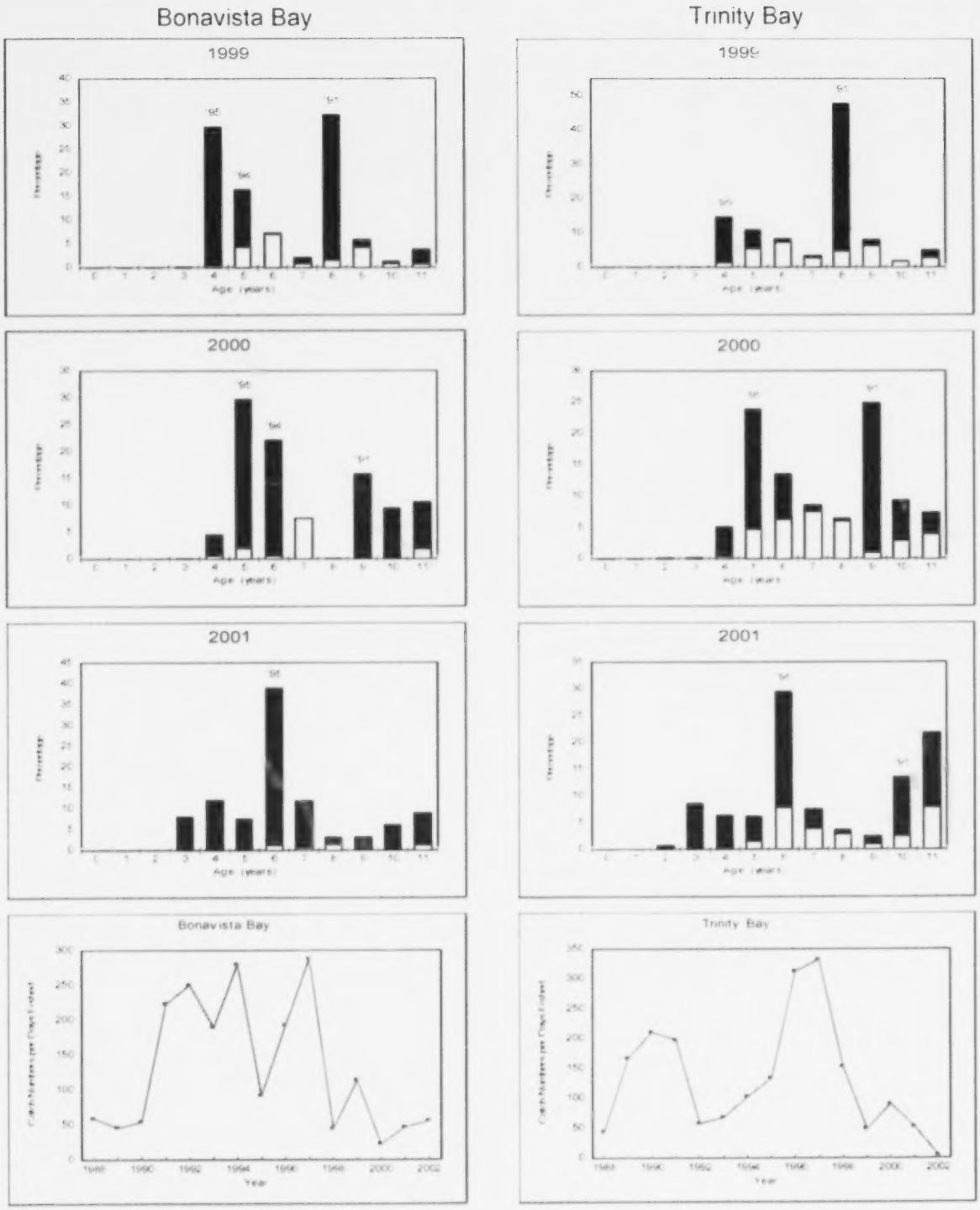

Figure 9. Herring age distributions (by number), 1999 – 2001, and catch rates (numbers per days fished), 1988 – 2002, from spring research gill net program for BB-TB separately.

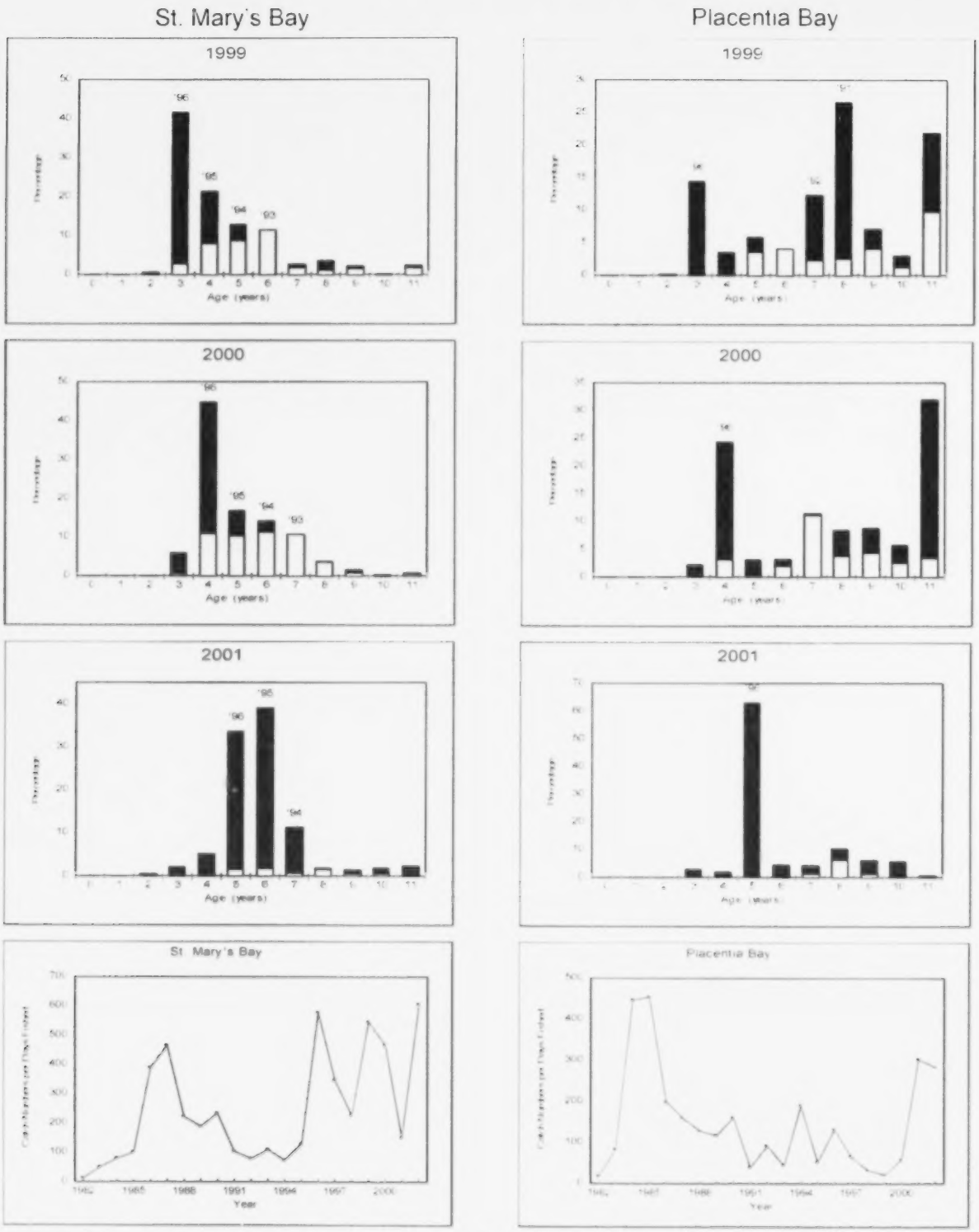

Figure 10. Herring age distributions (by number), 1999 – 2001, and catch rates (numbers per days fished), 1988 – 2002, from the spring research gill net program for SMB-PB separately.

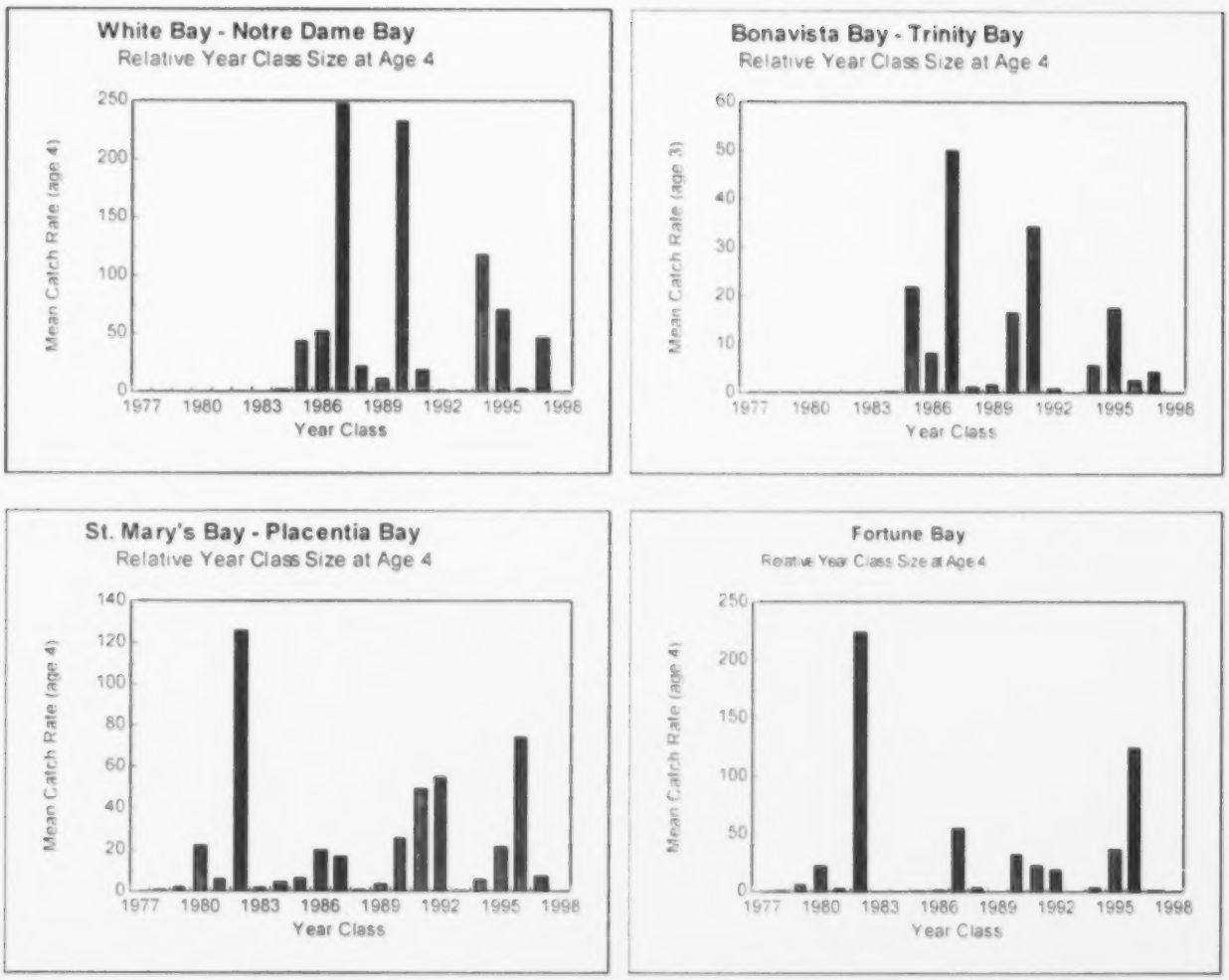
White Bay - Notre Dame Bay
Relative Year Class Size at Age 4
Mean Catch Rate (age 4)
Year Class
Bonavista Bay - Trinity Bay
Relative Year Class Size at Age 4
Mean Catch Rate (age 3)
Year Class
St. Mary's Bay - Placentia Bay
Relative Year Class Size at Age 4
Mean Catch Rate (age 4)
Year Class
Fortune Bay
Relative Year Class Size at Age 4
Mean Catch Rate (age 4)
Year Class

Figure 11. Estimation of relative year class sizes at age 4 from research gill net catch rates.

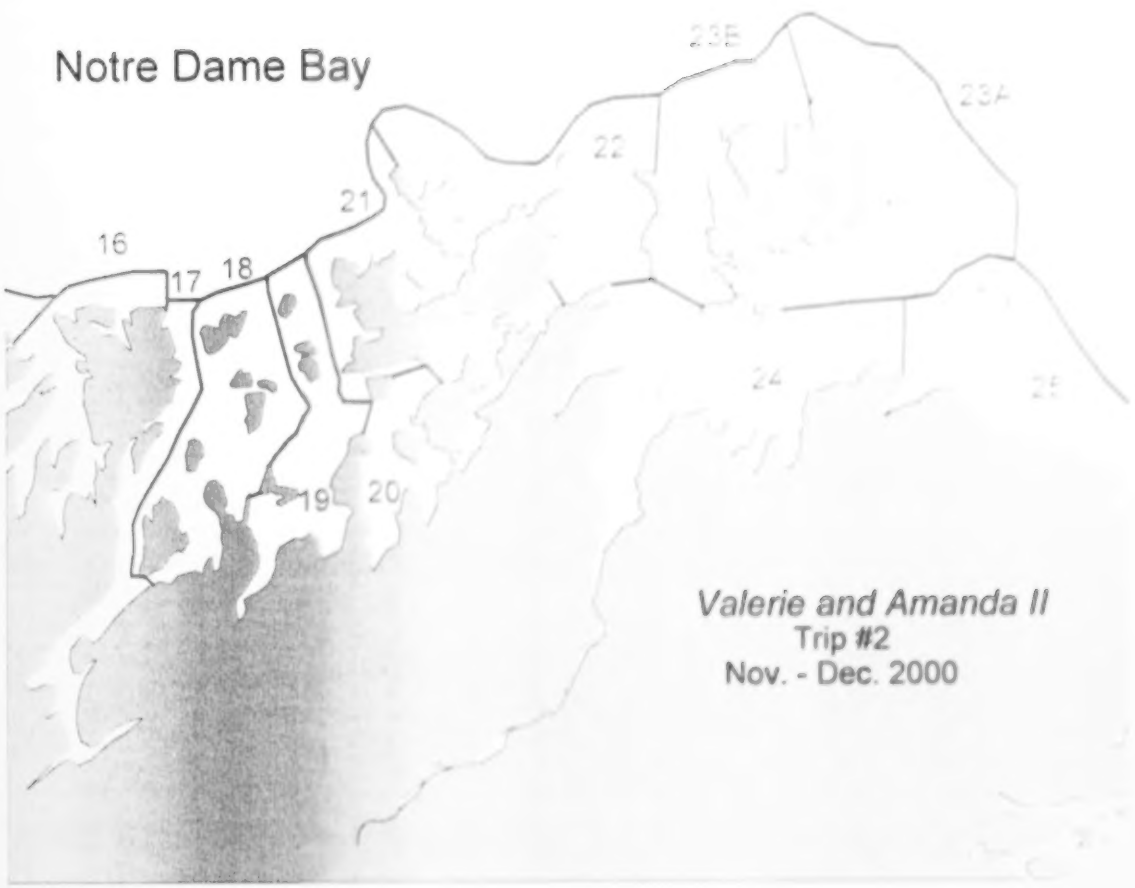

Figure 12. Area map of Notre Dame Bay indicating survey strata and transects for the 2000 inshore acoustic survey.

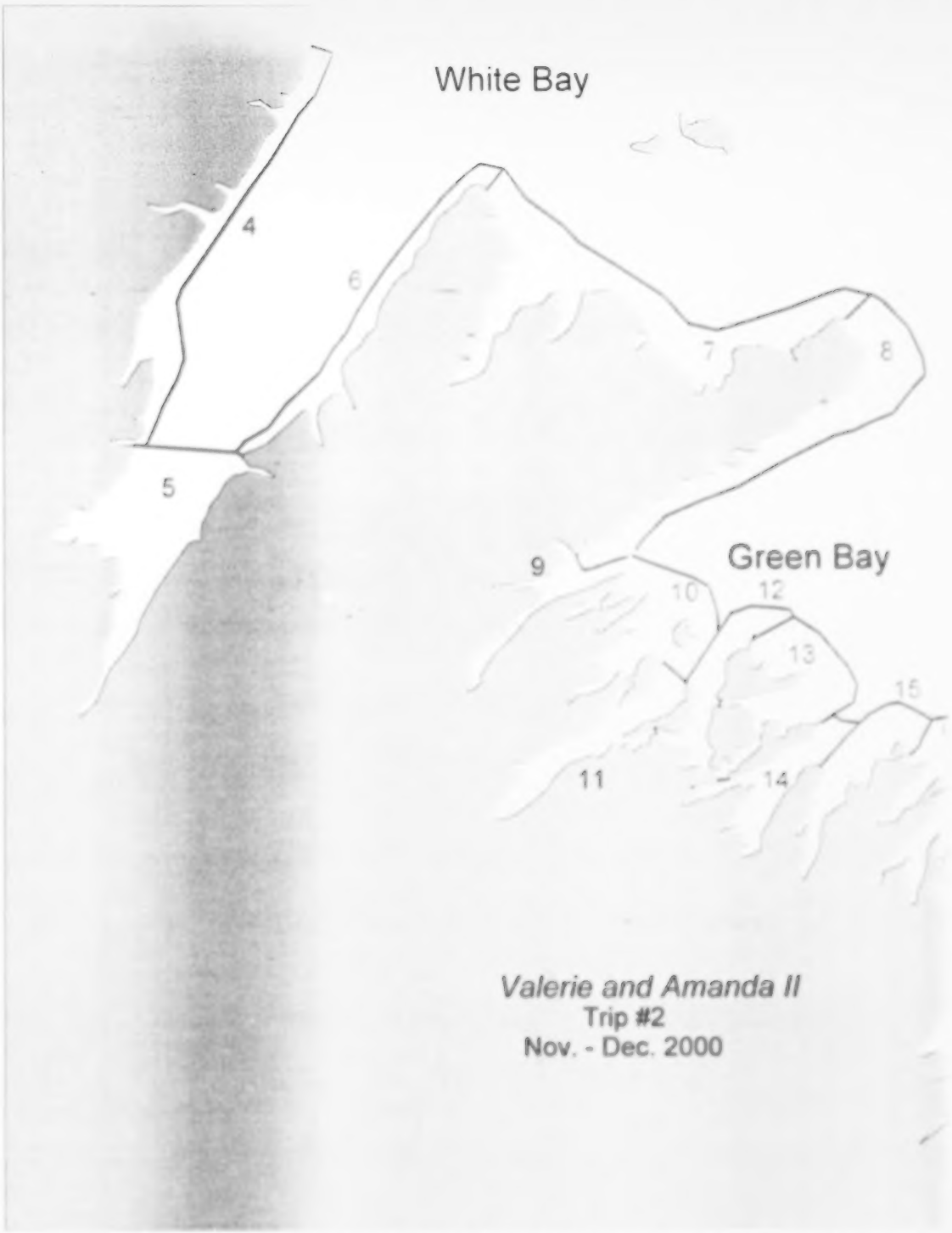

Figure 12 (cont.'). Area map of White Bay and Green Bay indicating survey strata and transects for the 2000 inshore acoustic survey.

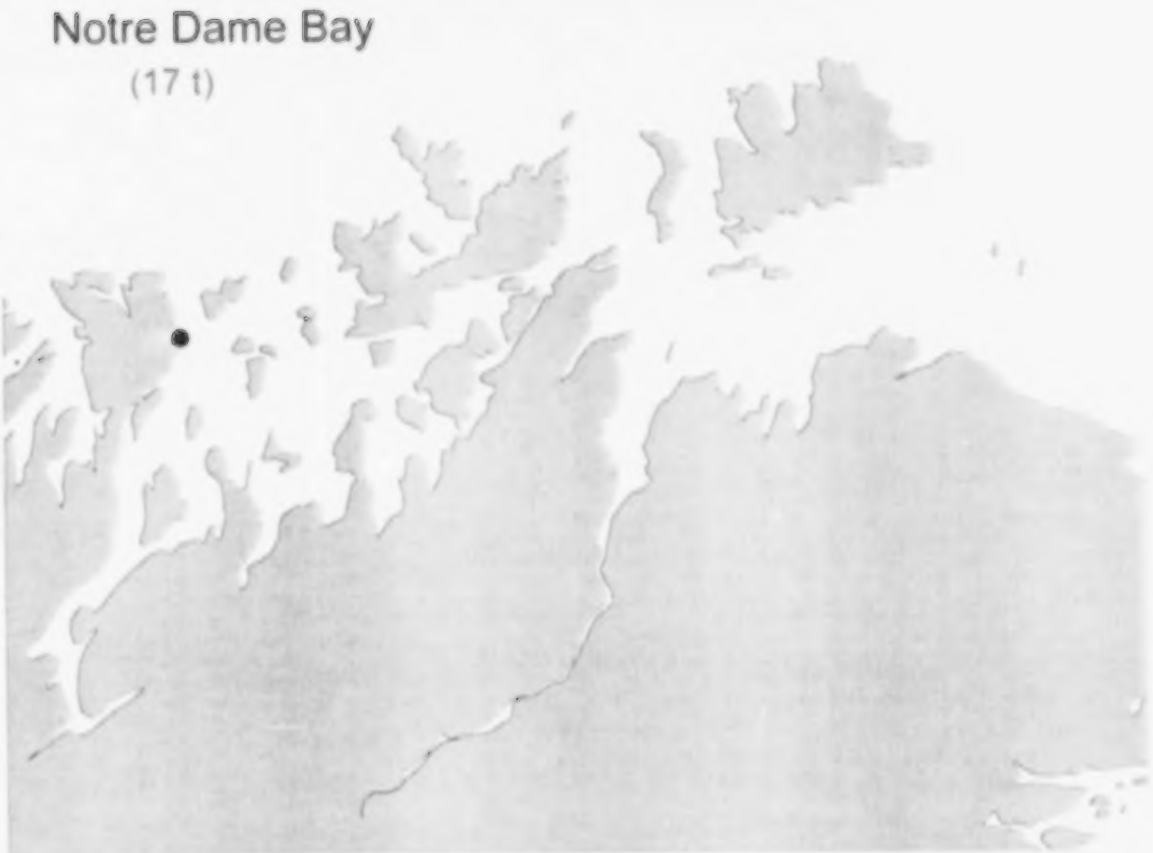

Figure 13. Distribution and density of herring on transects during the 2000 inshore acoustic survey of White Bay - Notre Dame Bay. Relative densities of herring are represented by expanding black symbols.

Figure 13 (cont.'). Distribution and density of herring on transects during the 2000 inshore acoustic survey of White Bay - Notre Dame Bay. Relative densities of herring are represented by expanding black symbols.

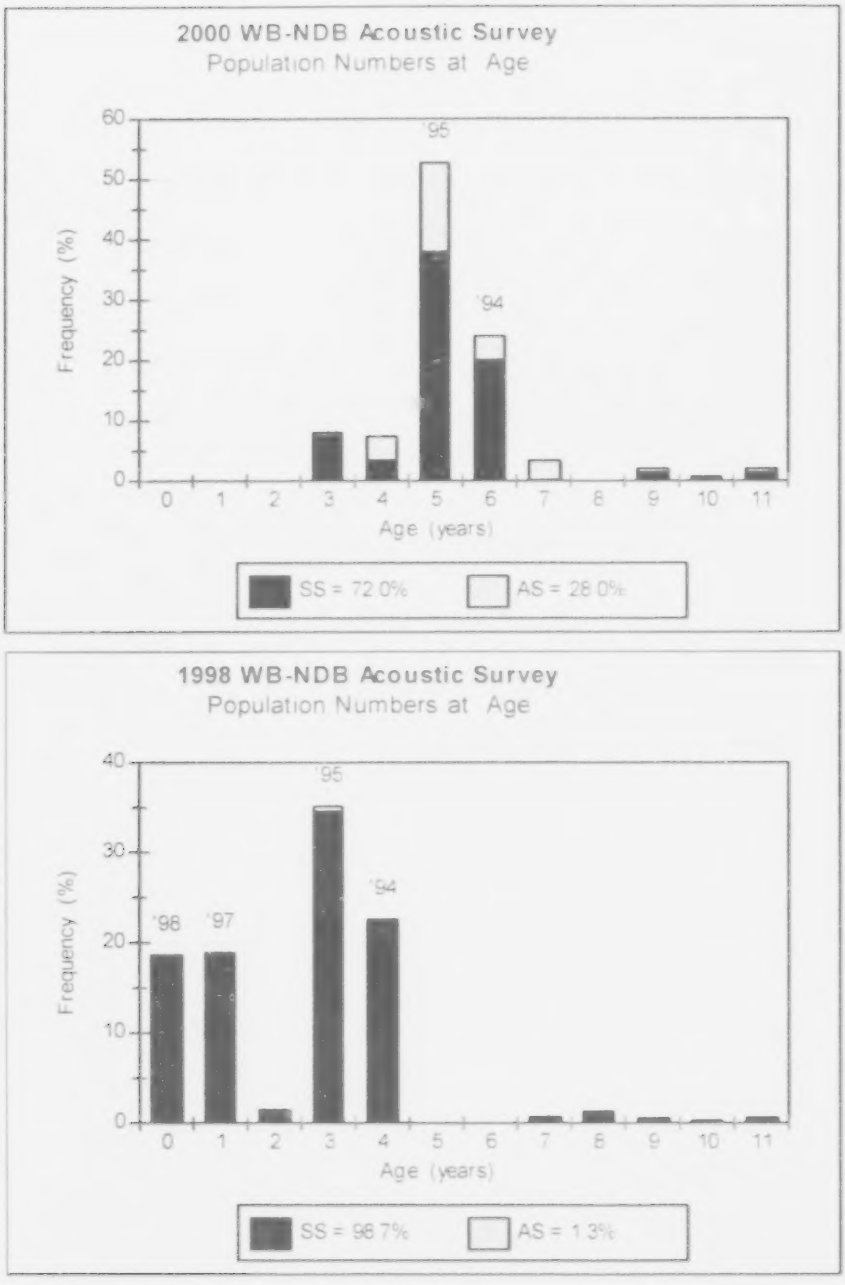

Figure 14. Age distributions from the 1998 and 2000 White Bay – Notre Dame Bay acoustic surveys.

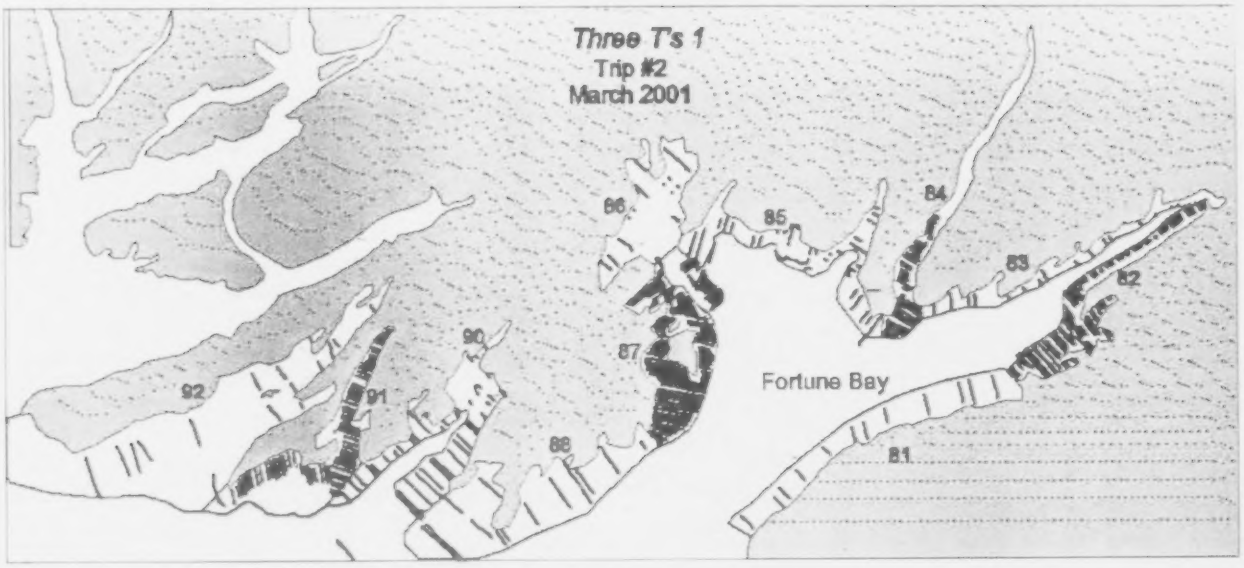

Figure 15. Area map of Fortune Bay indicating survey strata and transects for the 2001 inshore acoustic survey.

Figure 16. Distribution and density of herring on transects during the 2001 inshore acoustic survey of Fortune Bay. Relative densities of herring are represented by expanding black symbols.

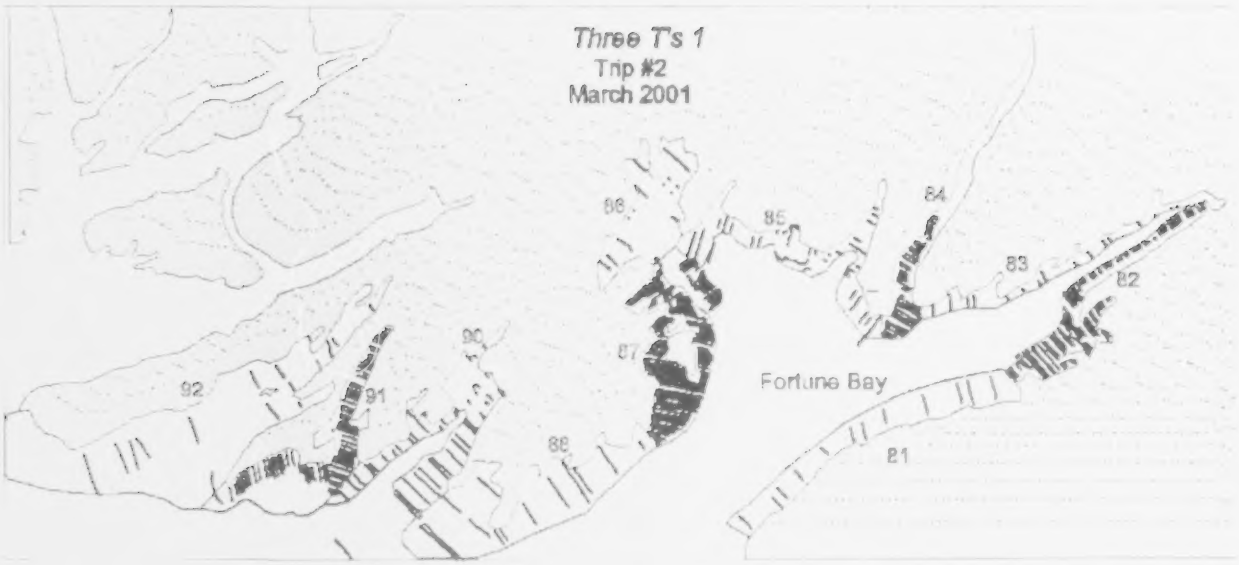

Figure 15. Area map of Fortune Bay indicating survey strata and transects for the 2001 inshore acoustic survey.

Figure 16. Distribution and density of herring on transects during the 2001 inshore acoustic survey of Fortune Bay. Relative densities of herring are represented by expanding black symbols.

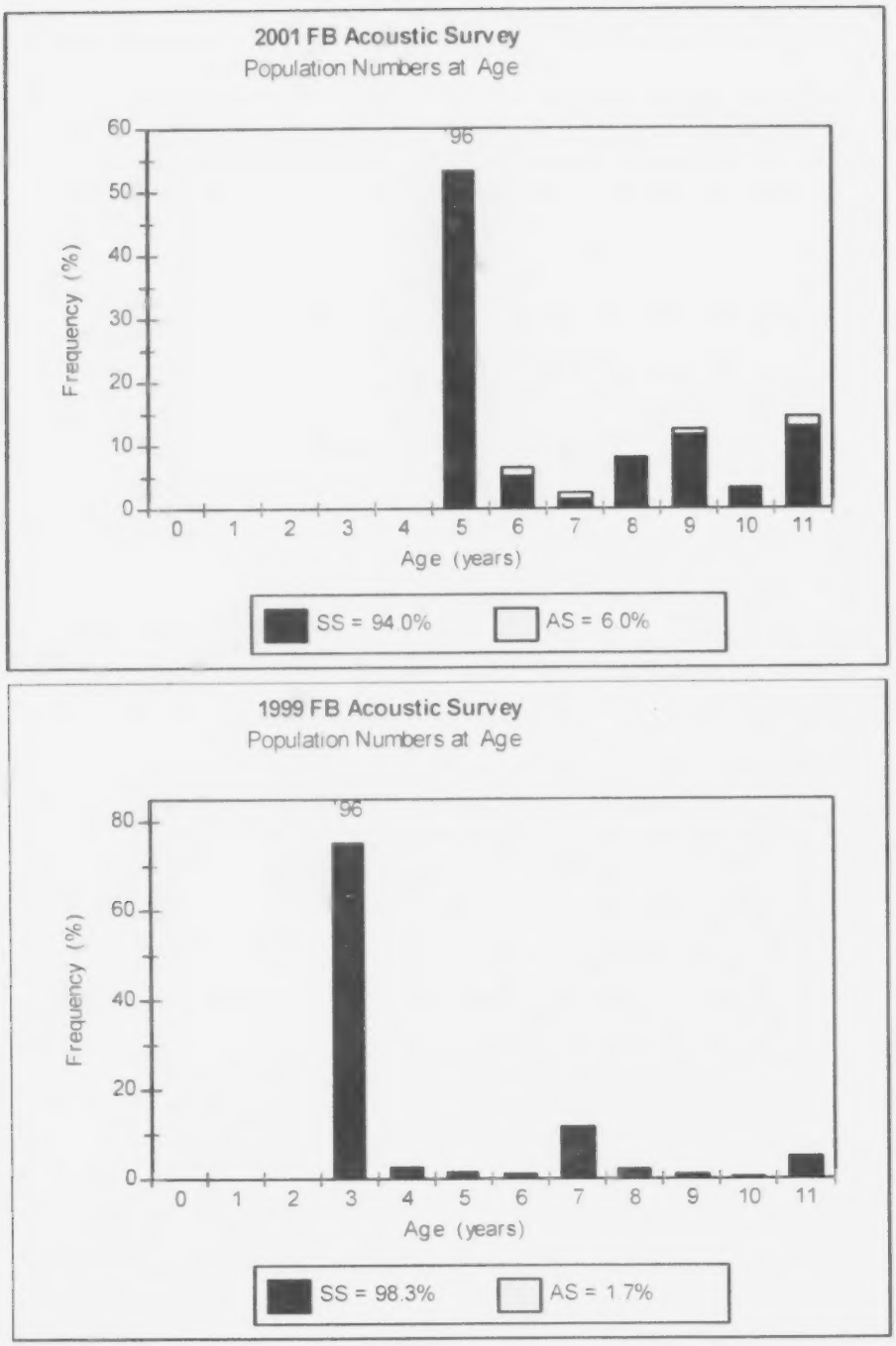

Figure 17. Age distributions of herring from the 1999 and 2001 Fortune Bay acoustic surveys.

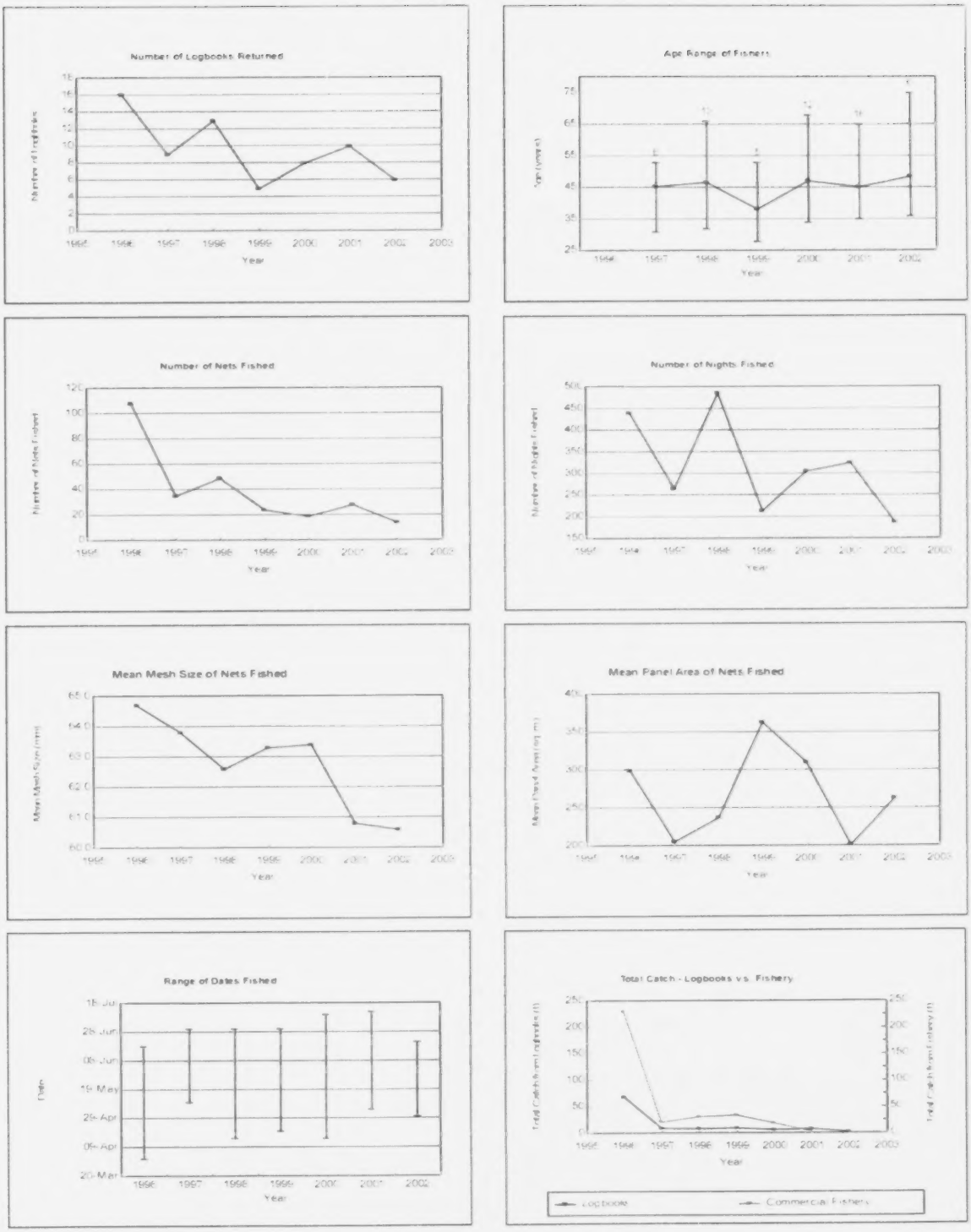

Figure 18. Annual parameters derived from commercial gill net logbooks for White Bay – Notre Dame Bay.

Figure 19. Commercial herring gill net locations, by year, for White Bay – Notre Dame Bay, from commercial gill net logbooks.

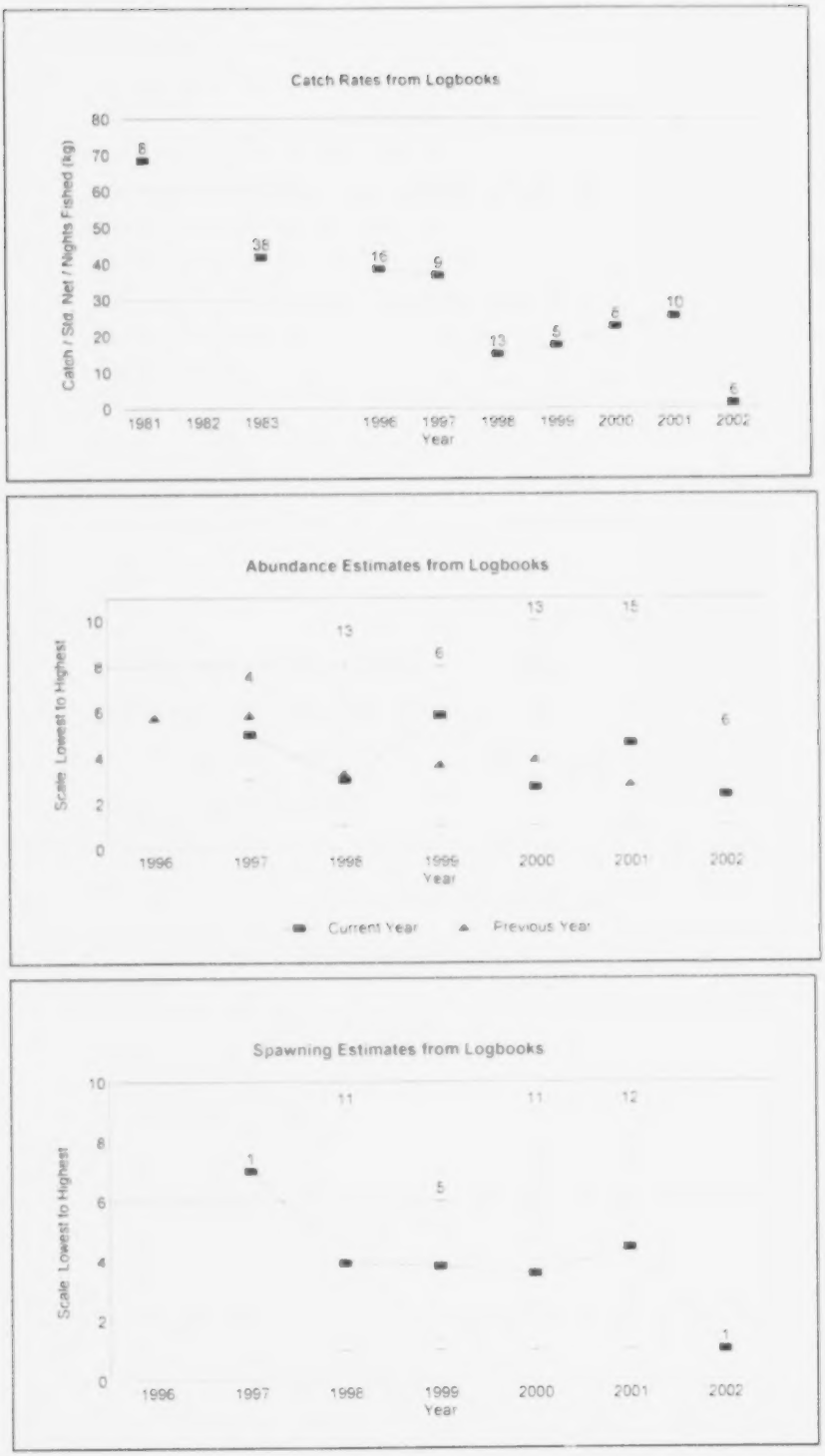

Figure 20. Annual abundance indices derived from commercial gill net logbooks for White Bay – Notre Dame Bay.

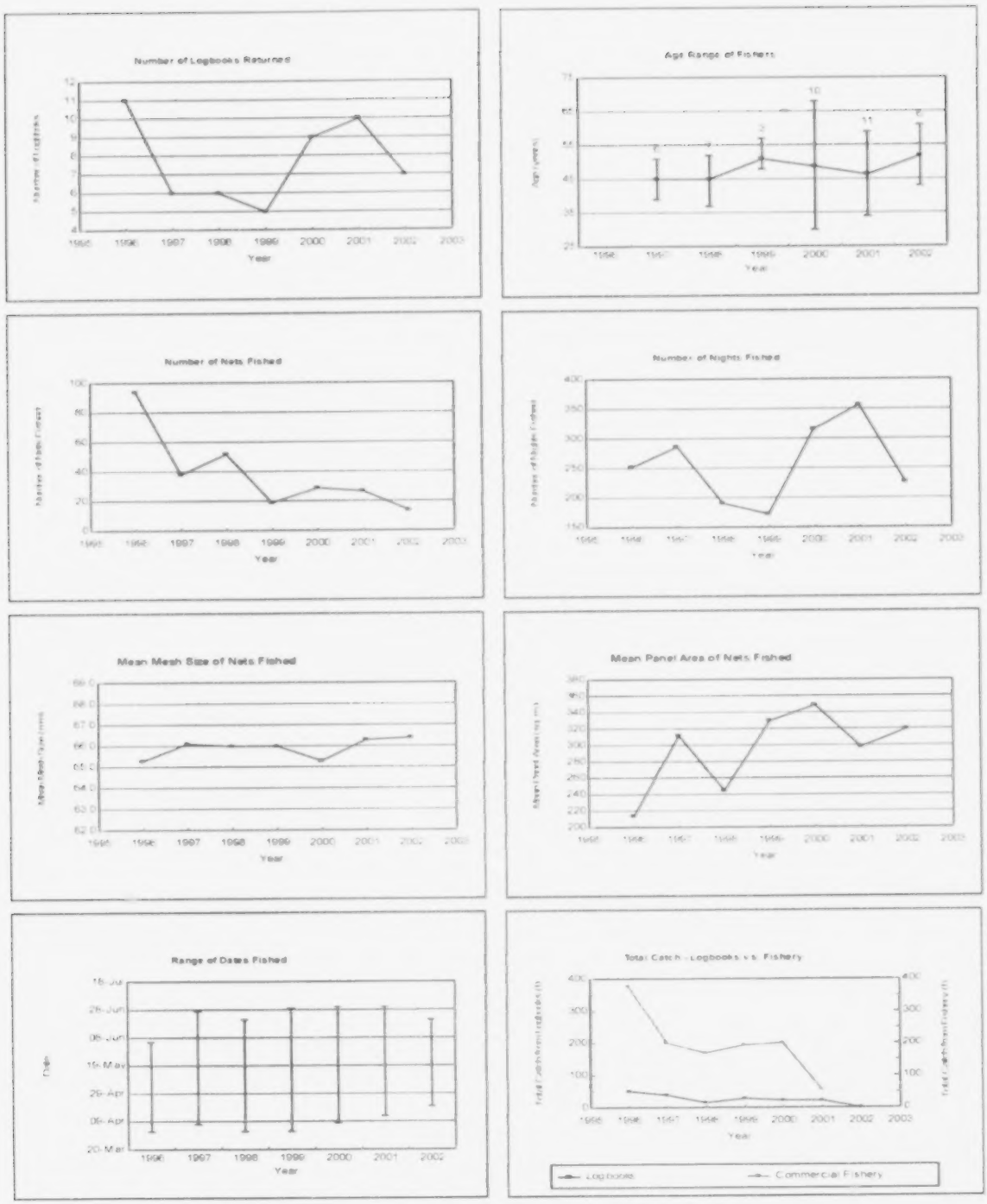

Figure 21. Annual parameters derived from commercial gill net logbooks for Bonavista Bay – Trinity Bay.

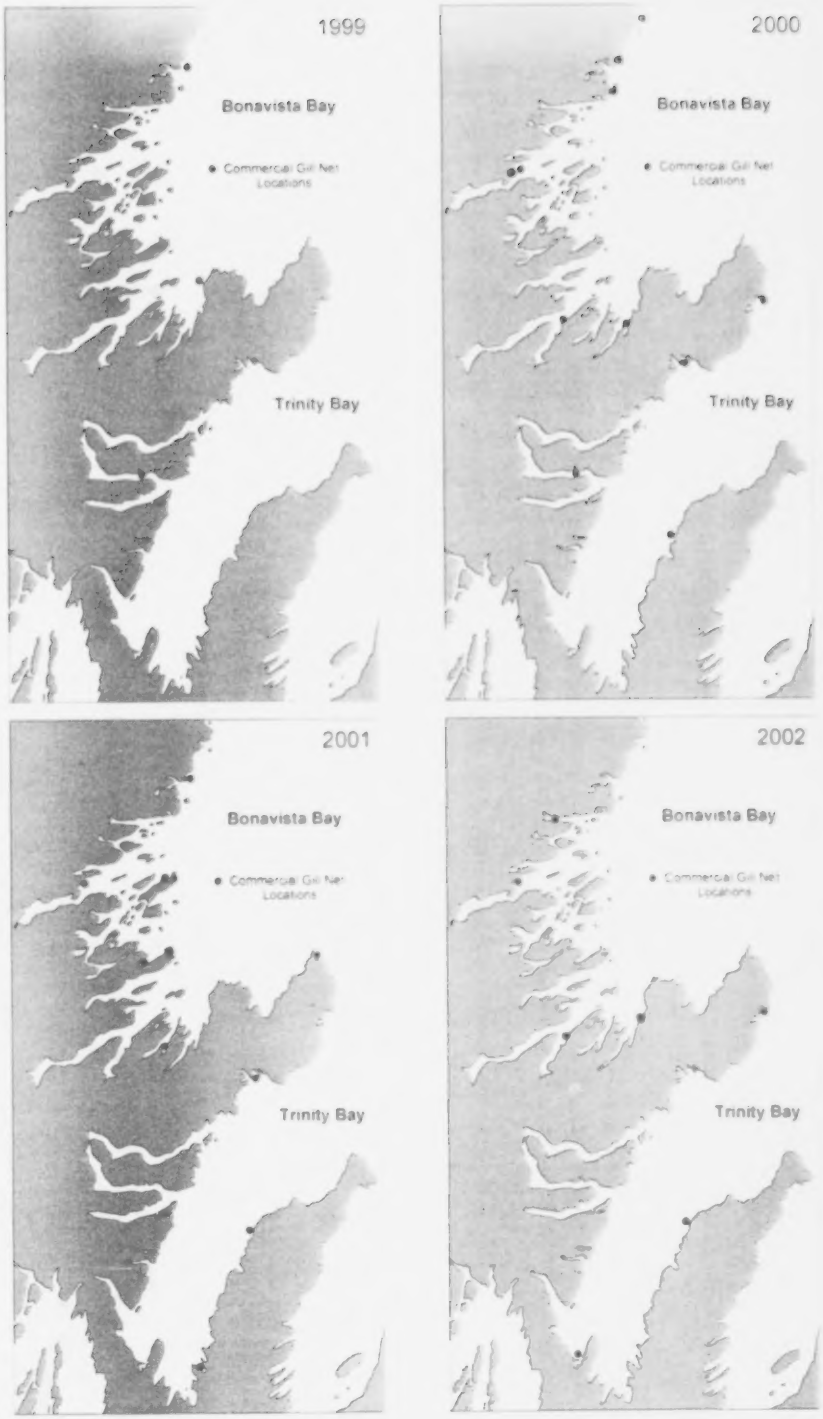

Figure 22. Commercial herring gill net set locations, by year, for Bonavista Bay – Trinity Bay, from commercial gill net logbooks.

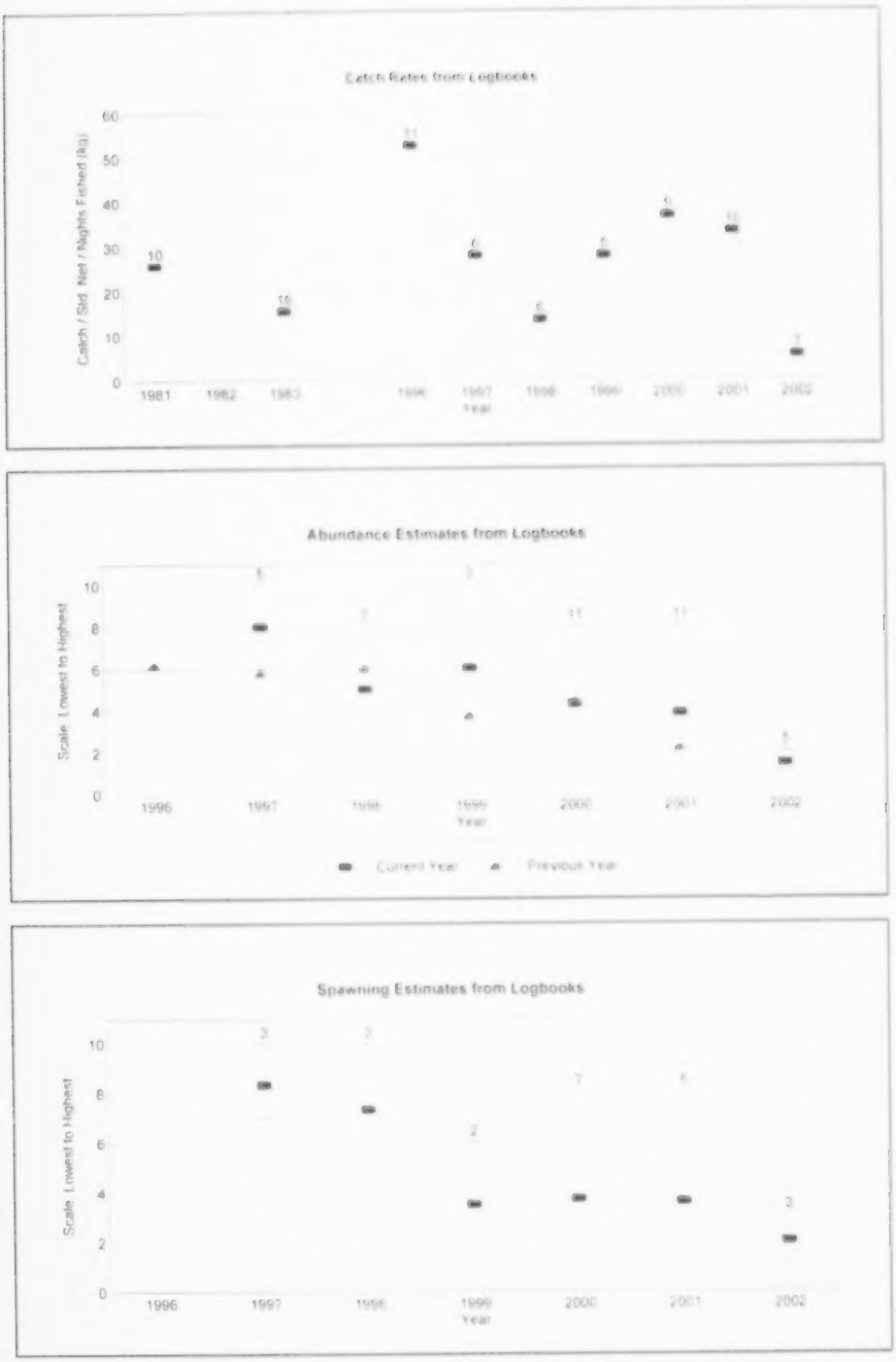

Figure 23. Annual abundance indices derived from commercial gill net logbooks for Bonavista Bay – Trinity Bay.

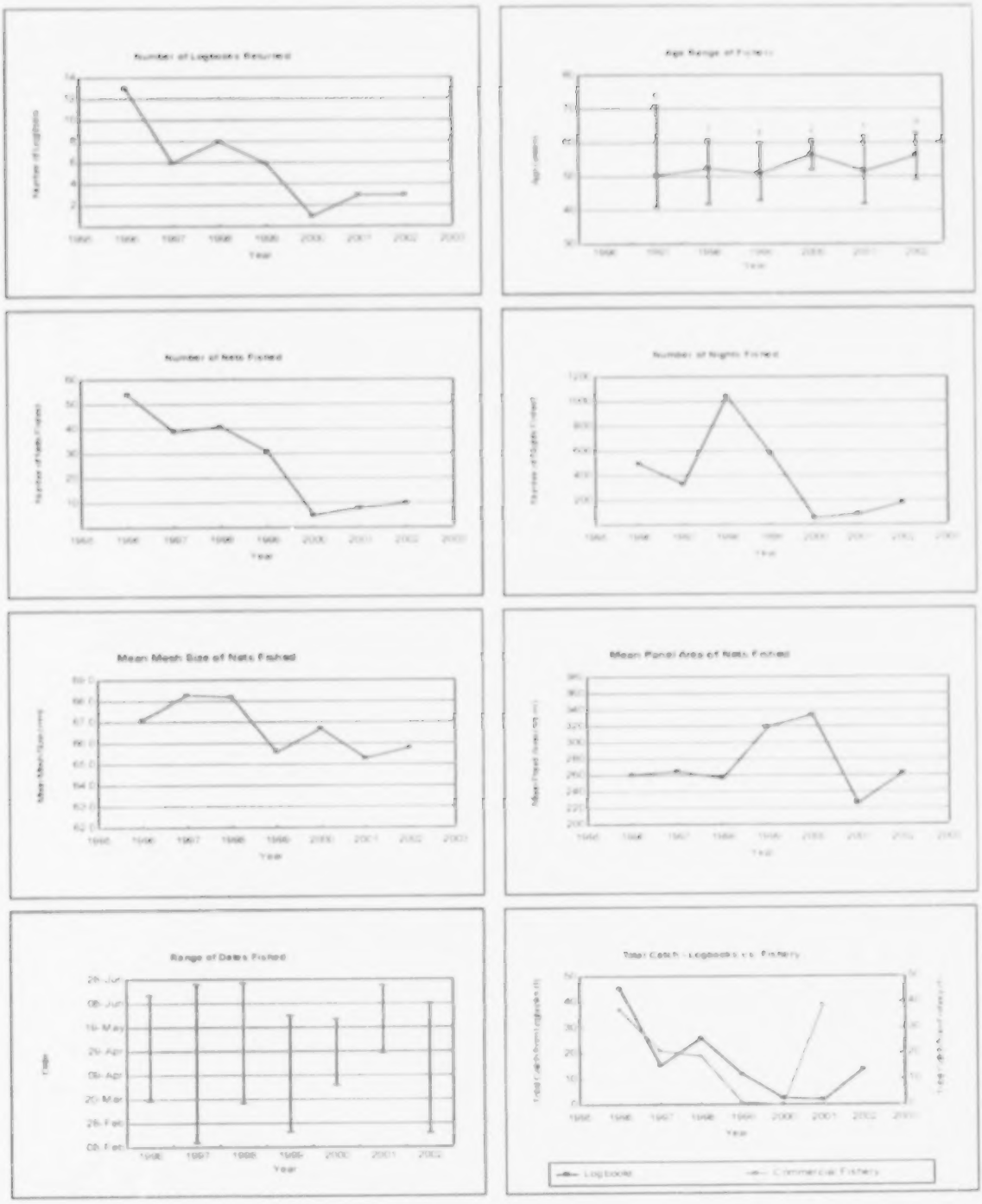

Figure 24. Annual parameters derived from commercial gill net logbooks for St. Mary's Bay – Placentia Bay.

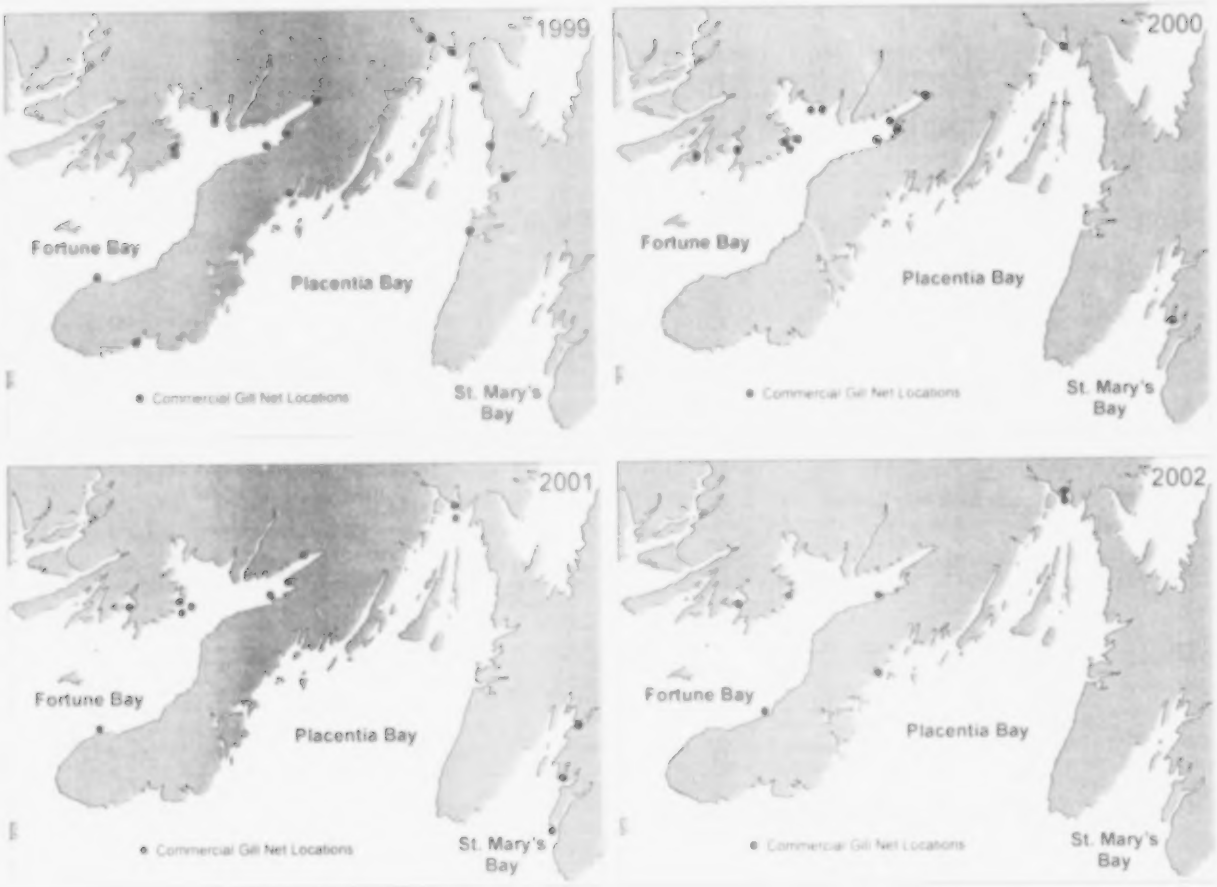

Figure 25. Commercial herring gill net set locations, by year, for St. Mary's Bay – Placentia Bay and Fortune Bay, from commercial gill net logbooks.

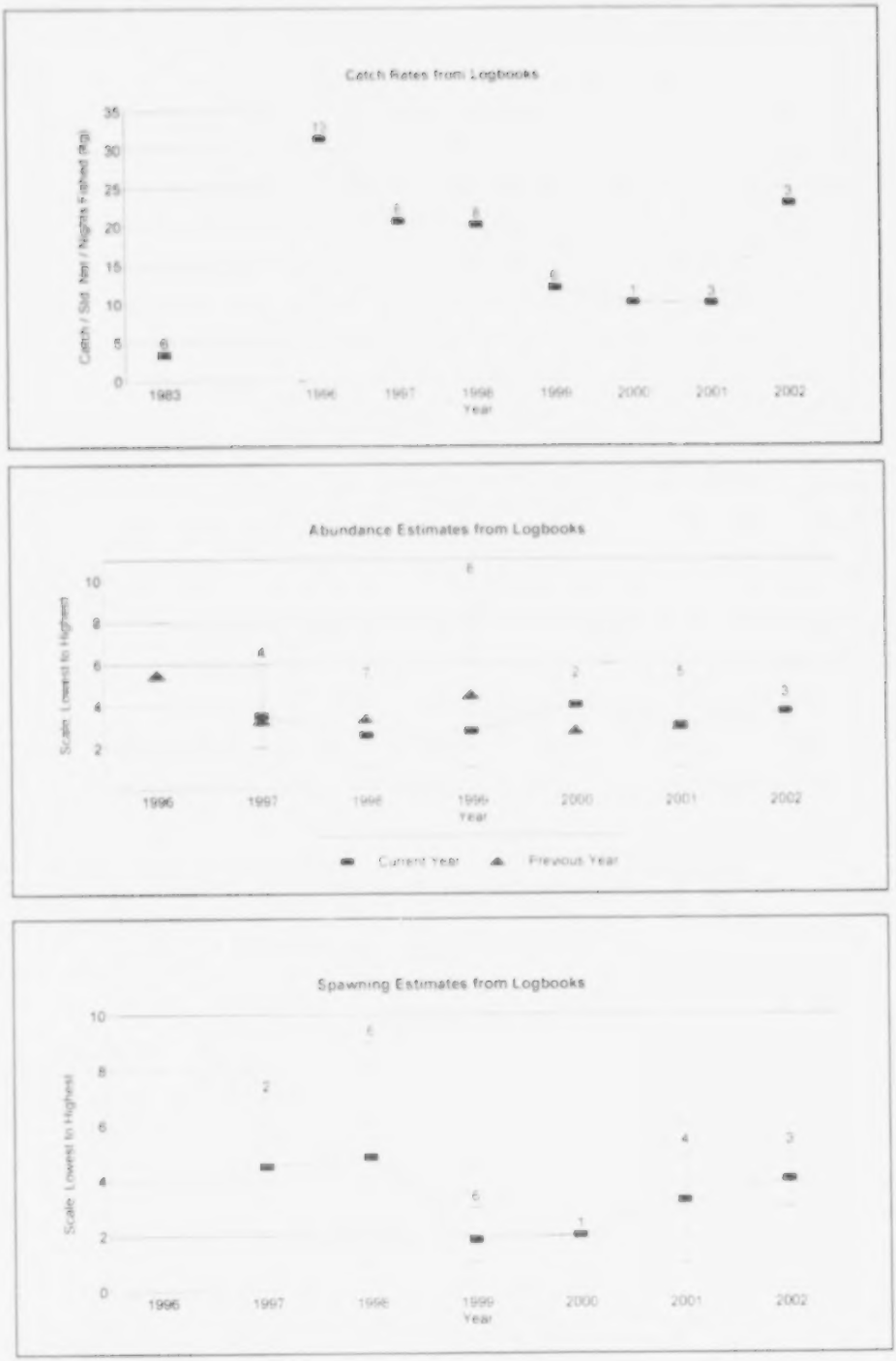

Figure 26. Annual abundance indices derived from commercial gill net logbooks for St. Mary's Bay – Placentia Bay.

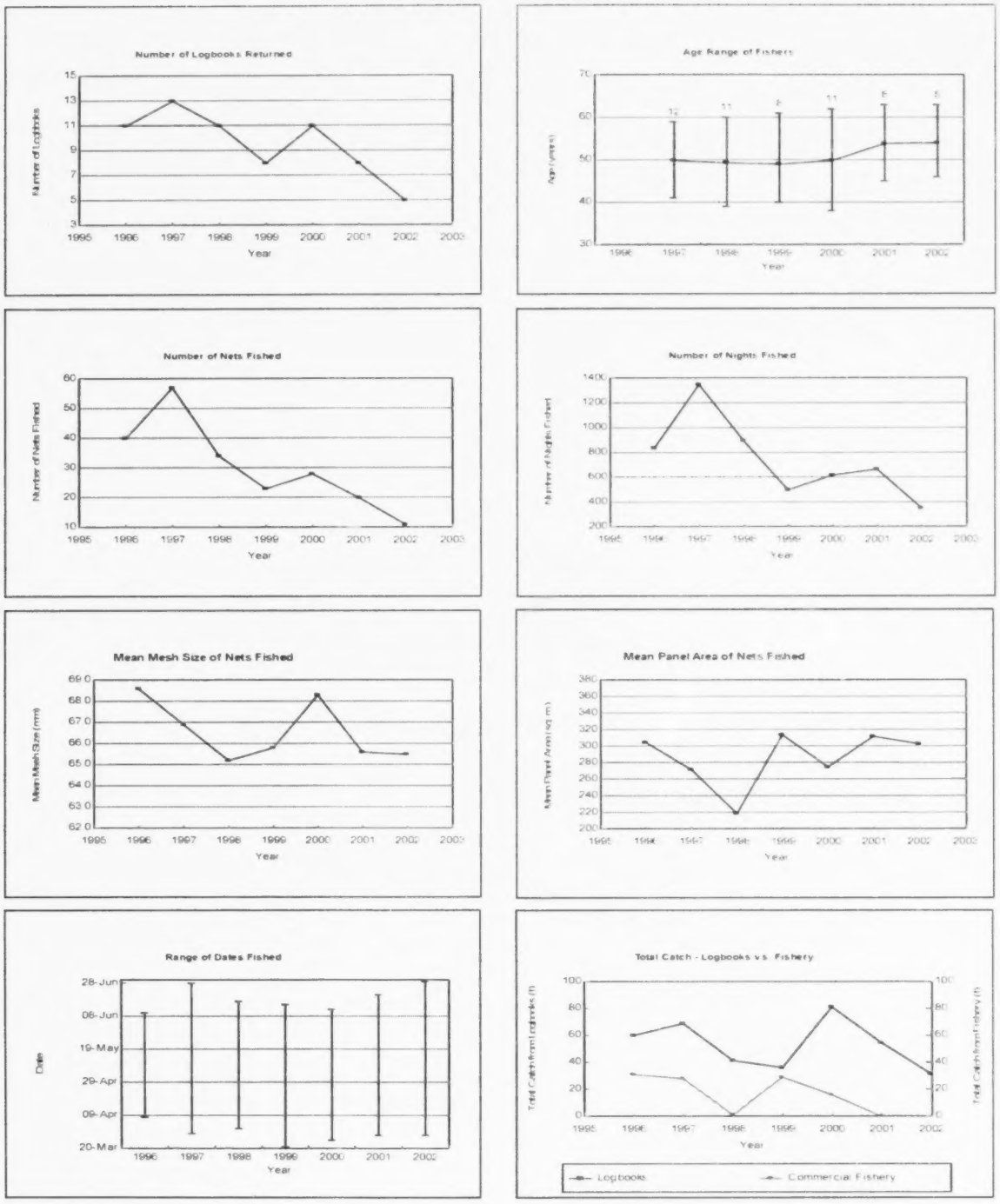

Figure 27. Annual parameters derived from commercial gill net logbooks for Fortune Bay.

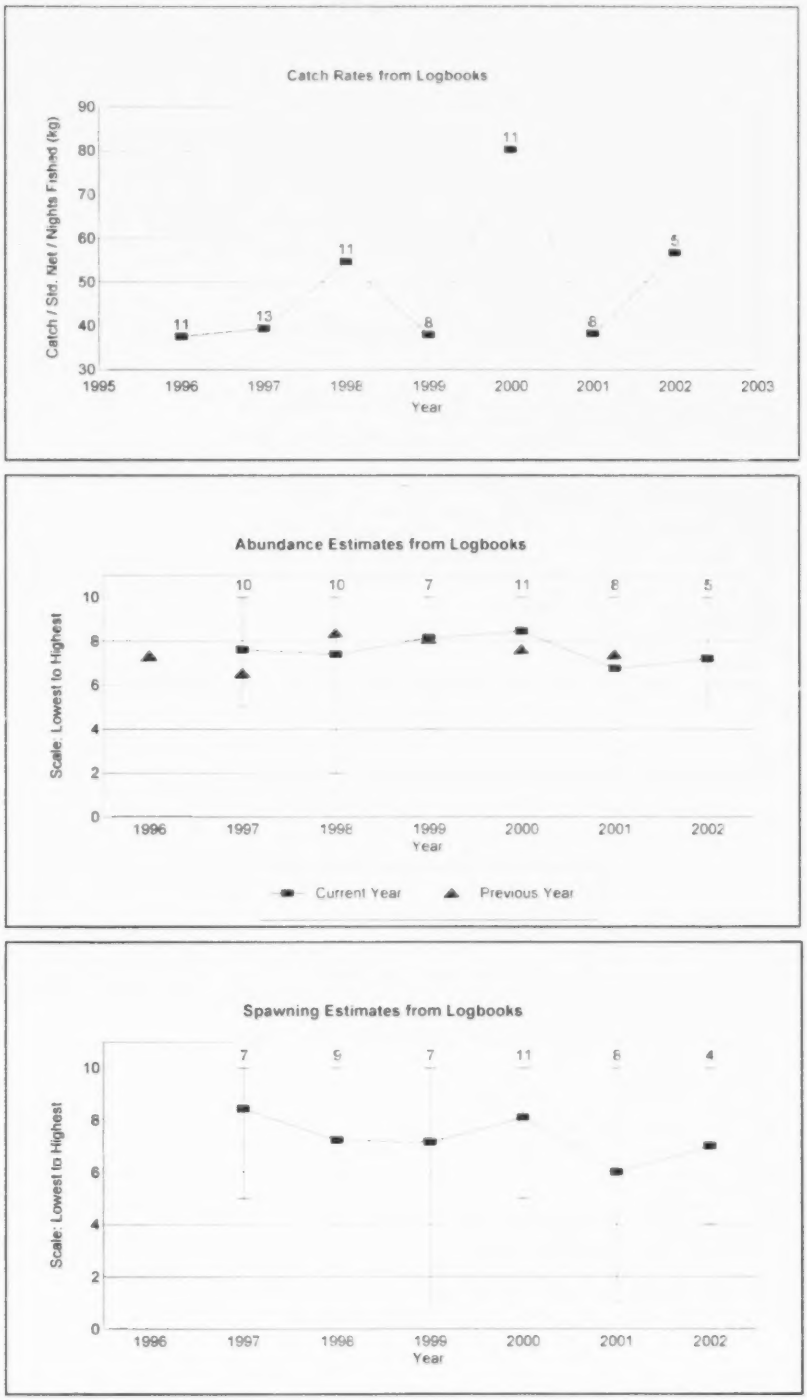

Figure 28. Annual abundance indices derived from commercial gill net logbooks for Fortune Bay.

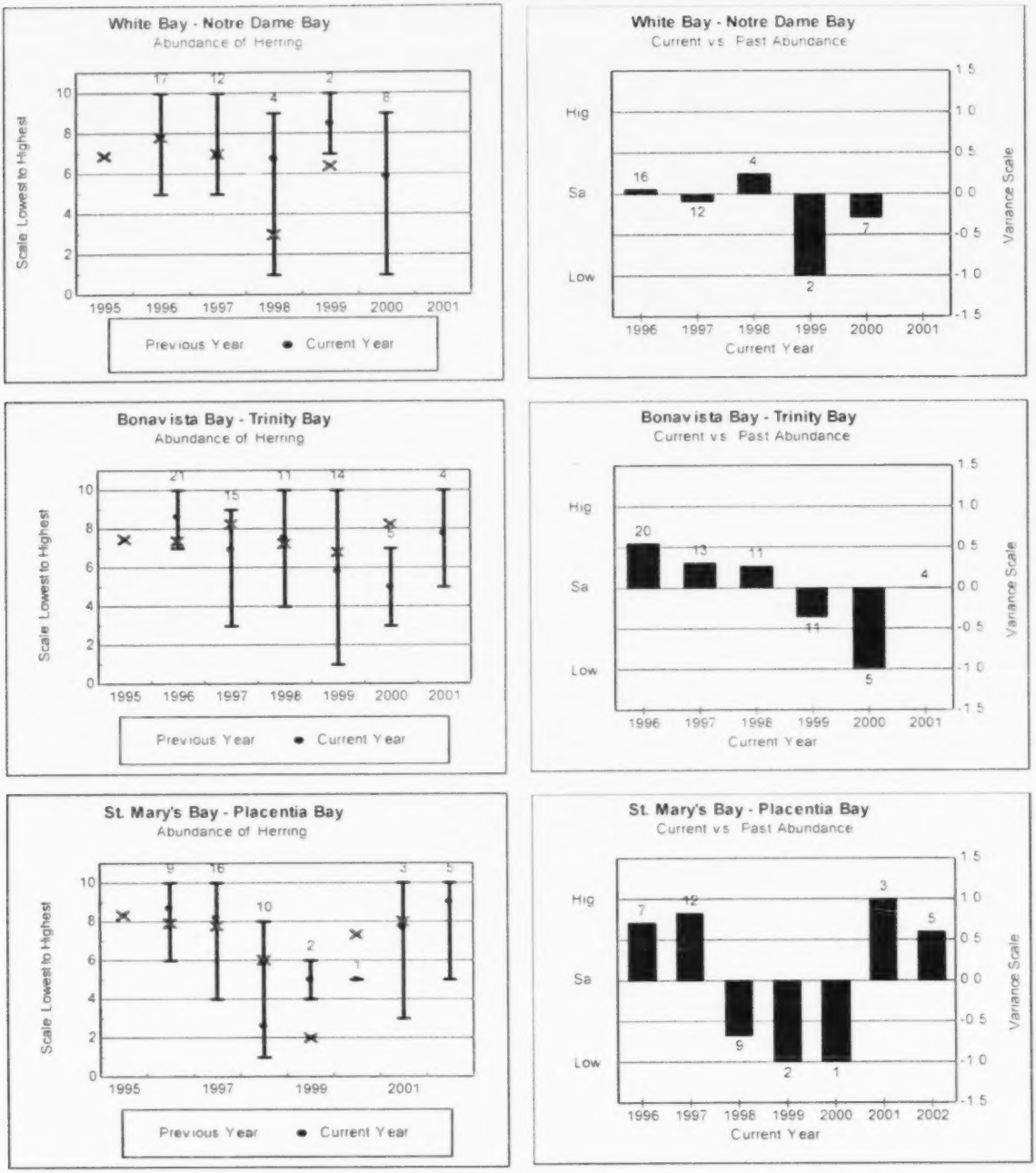

Figure 29. Responses to questions regarding abundance (numbers) of herring in home bay in current year and previous year (left panels) compared to when you first started fishing herring (right panels). Solid circles represent means for the current year; x's represent means for the previous year as estimated during the current year. Vertical lines represent range of responses; sample sizes are listed above each vertical line and bar.

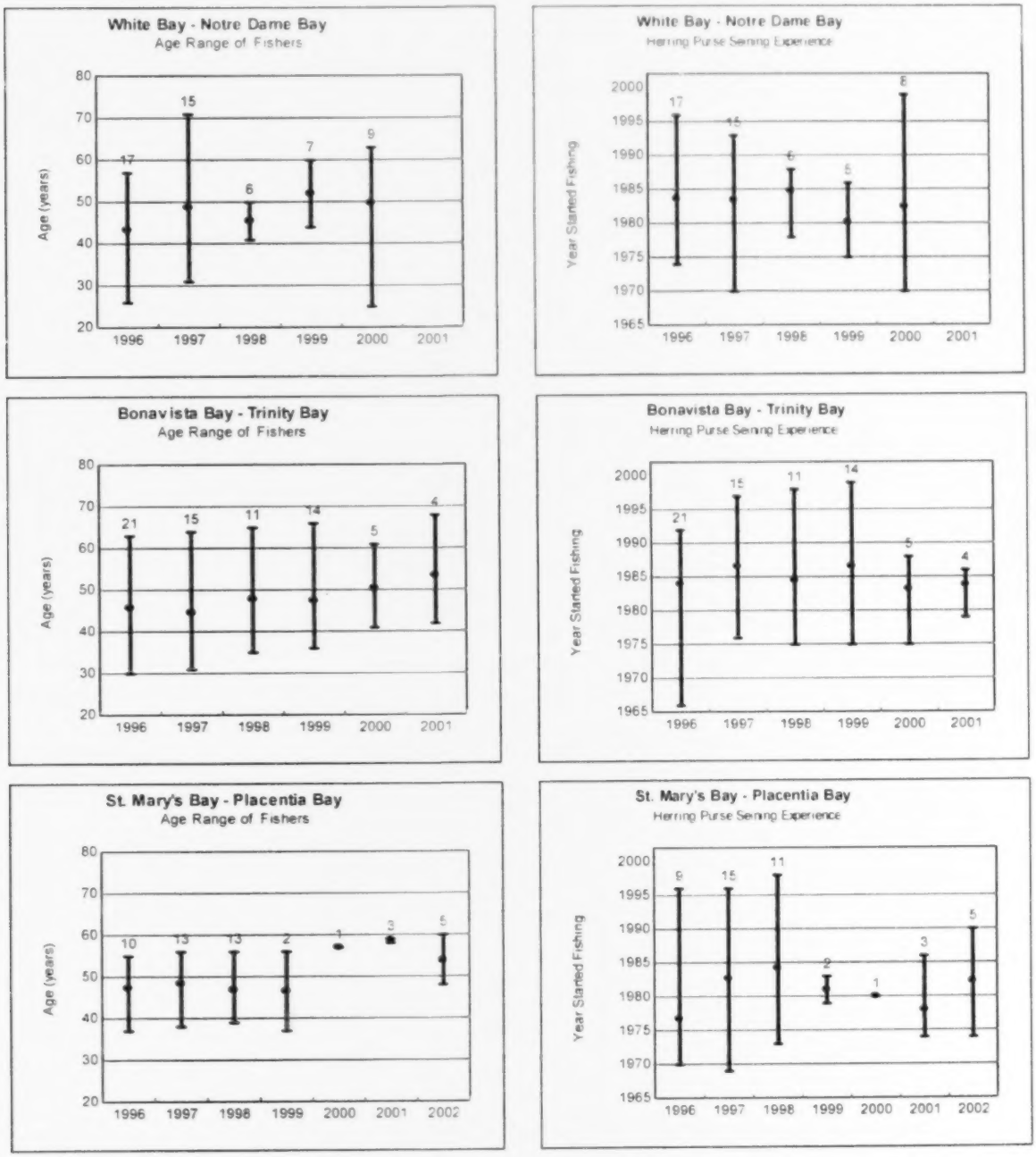

Figure 30. Age range and experience of purse seine fishers. Solid circles represent means for the current year, vertical lines represent the range of responses, and sample sizes are listed above each line.

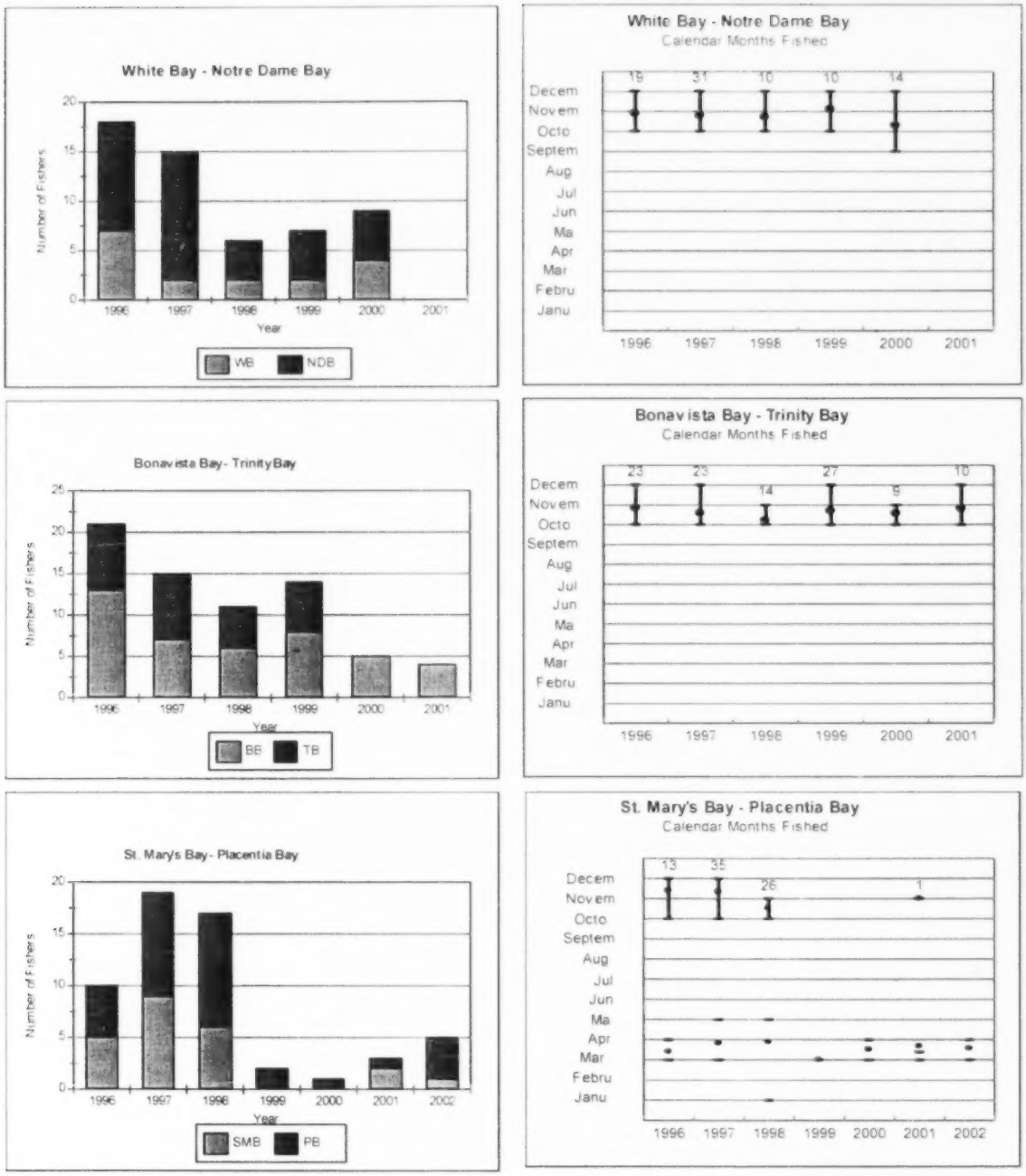

Figure 31. Responses to questions regarding bays fished (left panels) and months fished (right panels). Solid circles (right panels) represent means, horizontal bars represent the range of responses, and sample sizes are listed at the top.

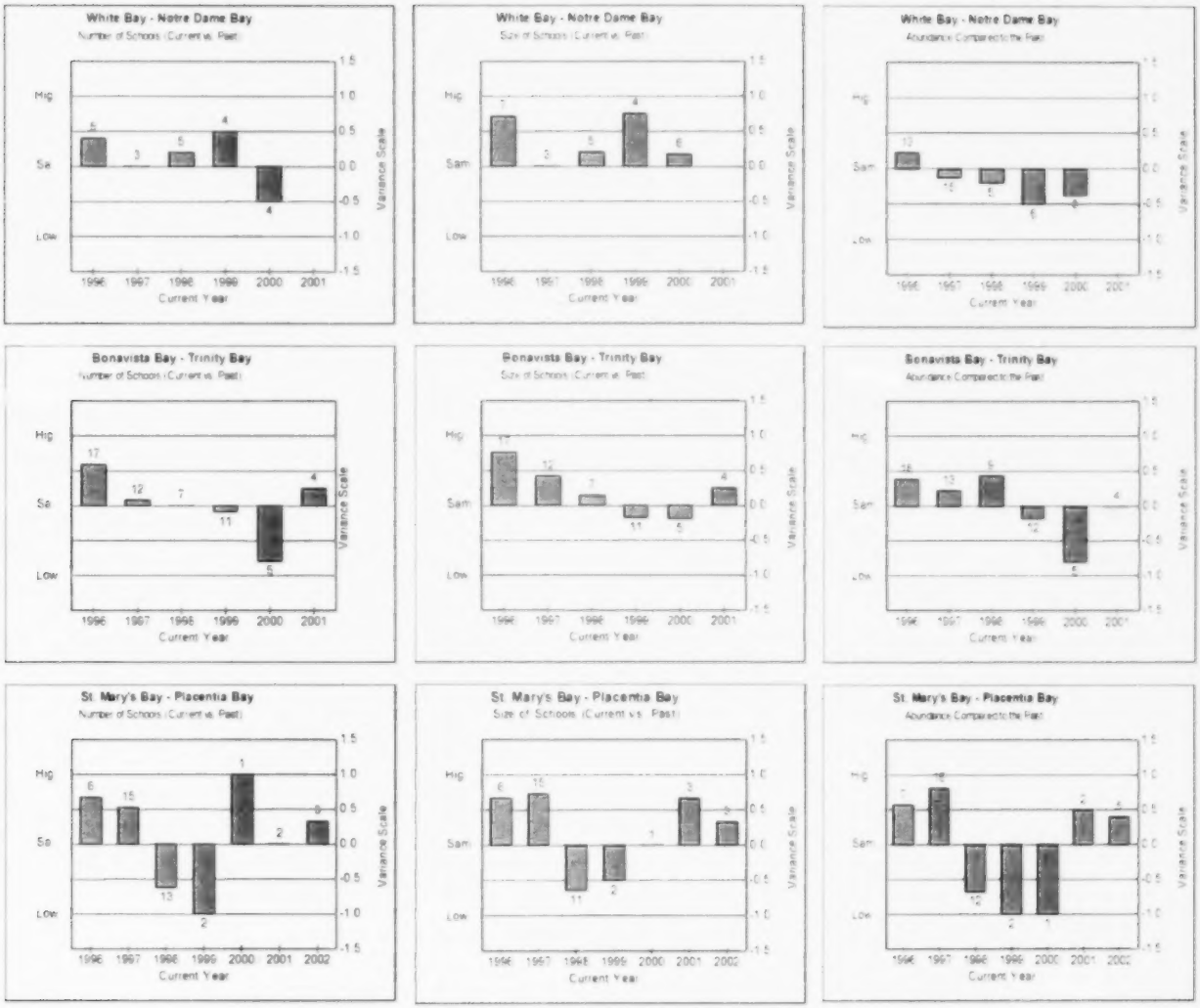

Figure 32. Responses to questions regarding the number (left panels) and size (middle panels) of herring schools detected (per day) during the fishery in the current year compared to the previous year, and abundance during the current year fishery compared to when you first started fishing herring (right panels). Sample sizes are listed above each bar.

White Bay - Notre Dame Bay
1996 Purse Seine Questionnaire
Locations of Successful Sets
Total Sets = 26
Successful Sets = 22
% Successful Sets = 84.6
% Successful Daytime Sets = 50.0
White Bay - Notre Dame Bay
1997 Purse Seine Questionnaire
Locations of Successful Sets
Total Sets = 264
Successful Sets = 207
% Successful Sets = 78.4
% Successful Daytime Sets = 80.6
White Bay - Notre Dame Bay
1998 Purse Seine Questionnaire
Locations of Successful Sets
Total Sets = 108
Successful Sets = 89
% Successful Sets = 82.4
% Successful Daytime Sets = 96.2
White Bay - Notre Dame Bay
1999 Purse Seine Questionnaire
Locations of Successful Sets
Total Sets = 70
Successful Sets = 43
% Successful Sets = 61.4
% Successful Daytime Sets = 100.0
White Bay - Notre Dame Bay
2000 Purse Seine Questionnaire
Locations of Successful Sets
Total Sets = 29
Successful Sets = 26
% Successful Sets = 89.7
% Successful Daytime Sets = 100.0

Figure 33. Responses to a question regarding locations of successful sets (sets in which herring were caught) in White Bay – Notre Dame Bay.

Figure 33 (cont.'). Responses to a question regarding locations of successful sets (sets in which herring were caught) in Bonavista – Trinity Bay.

St. Mary's Bay - Placentia Bay
1997 Purse Seine Questionnaire
Locations of Successful Sets
St. Mary's Bay - Placentia Bay
1999 Purse Seine Questionnaire
Locations of Successful Sets
St. Mary's Bay - Placentia Bay
2000 Purse Seine Questionnaire
Locations of Successful Sets
St. Mary's Bay - Placentia Bay
2001 Purse Seine Questionnaire
Locations of Successful Sets
St. Mary's Bay - Placentia Bay
2002 Purse Seine Questionnaire
Locations of Successful Sets

Figure 33 (cont.'). Responses to a question regarding locations of successful sets (sets in which herring were caught) in St. Mary's Bay – Placentia Bay.

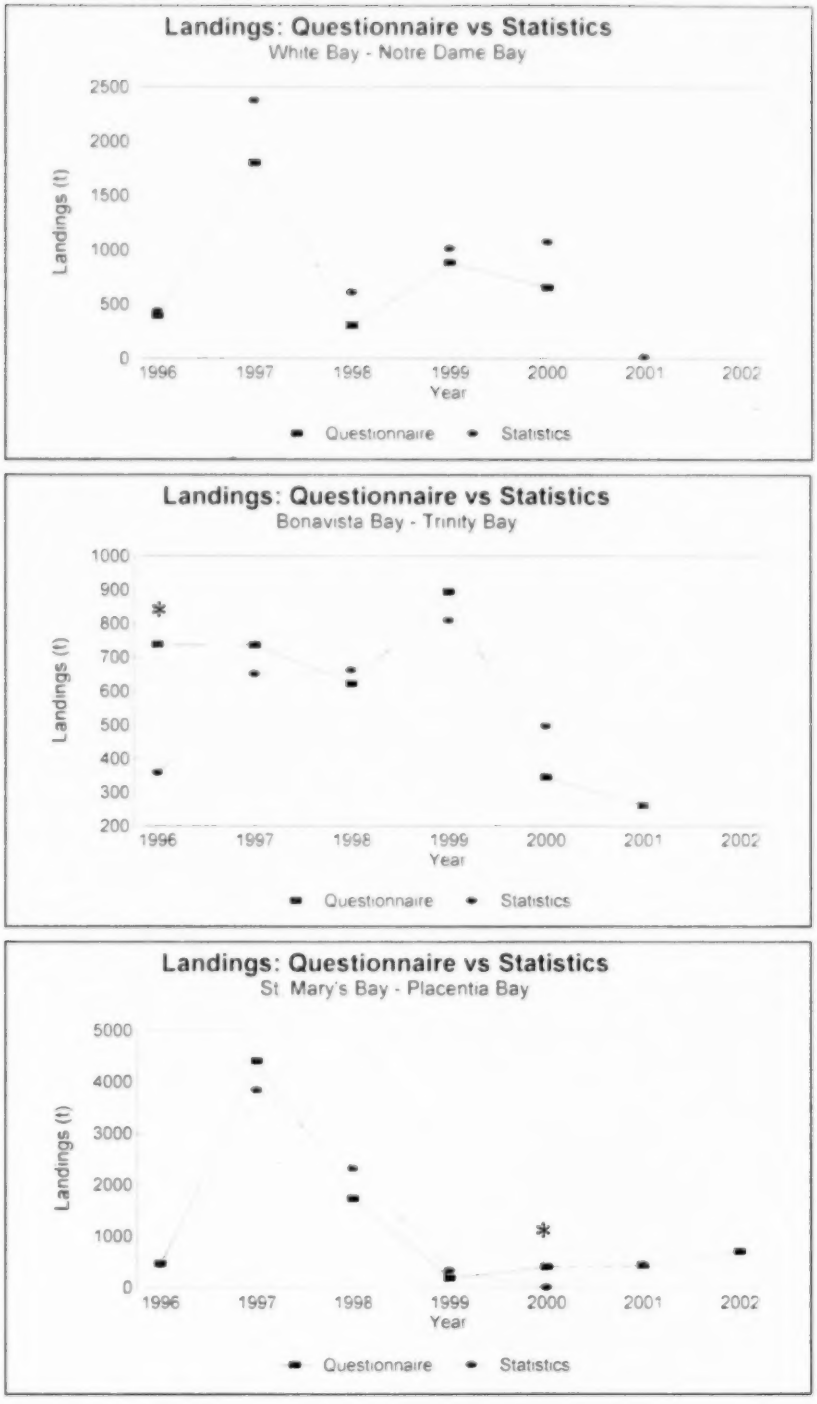

Figure 34. Comparison of landings from purse seine questionnaires and from commercial statistics, 1996 – 2001.

Figure 35. Responses to a question regarding why herring were discarded during the fishery.

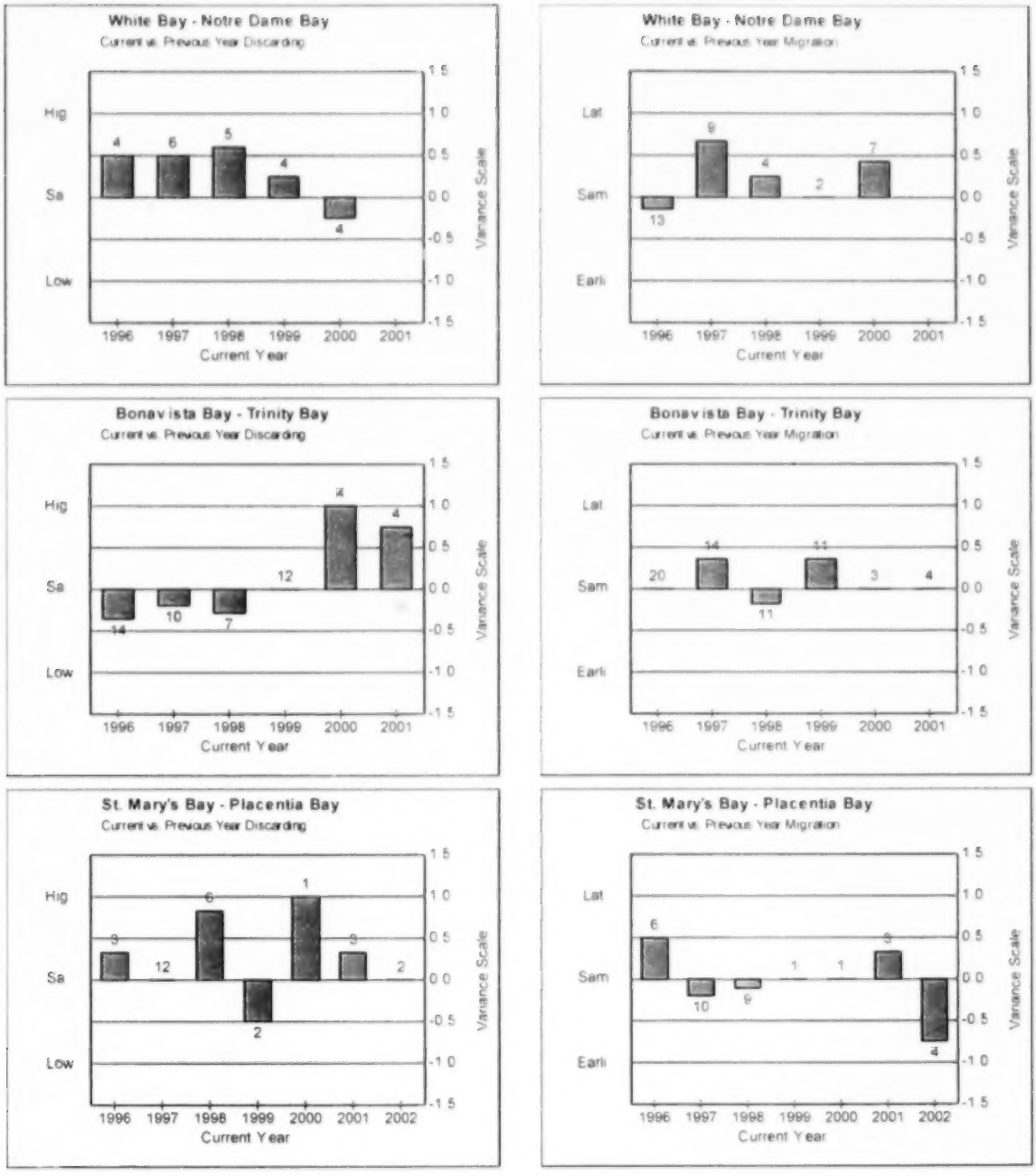

Figure 36. Responses to questions regarding the amount of herring discarded during the fishery in the current year compared to the previous year (left panels), and responses regarding the seasonal timing of herring migration in the current year compared to the previous year (right panels). Sample sizes are listed above each bar.

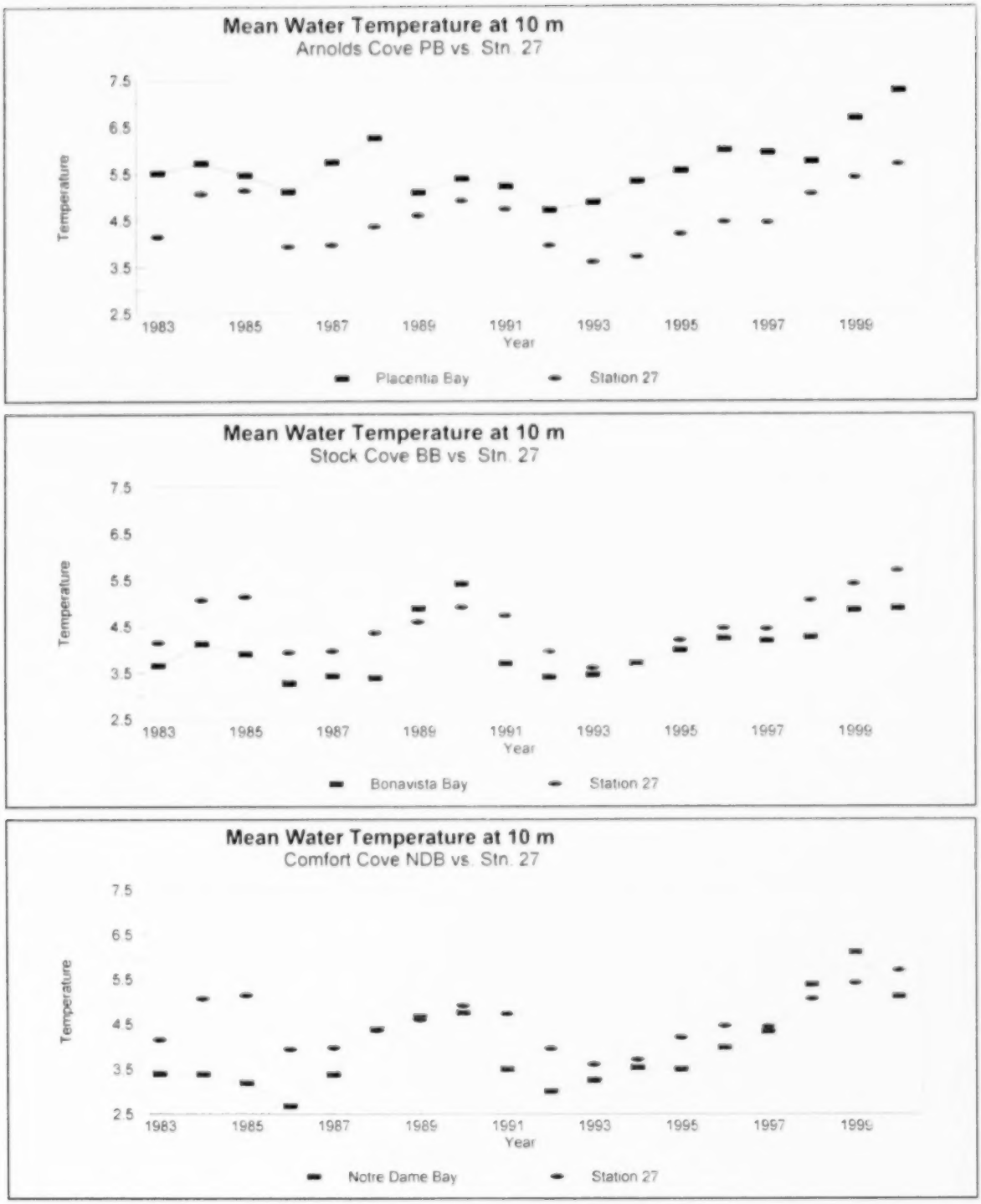

Figure 37. Comparison of water temperatures (two year running mean), 1983 – 2000, from Placentia Bay, Bonavista Bay, and Notre Dame Bay, with Station 27 (off St. John's).

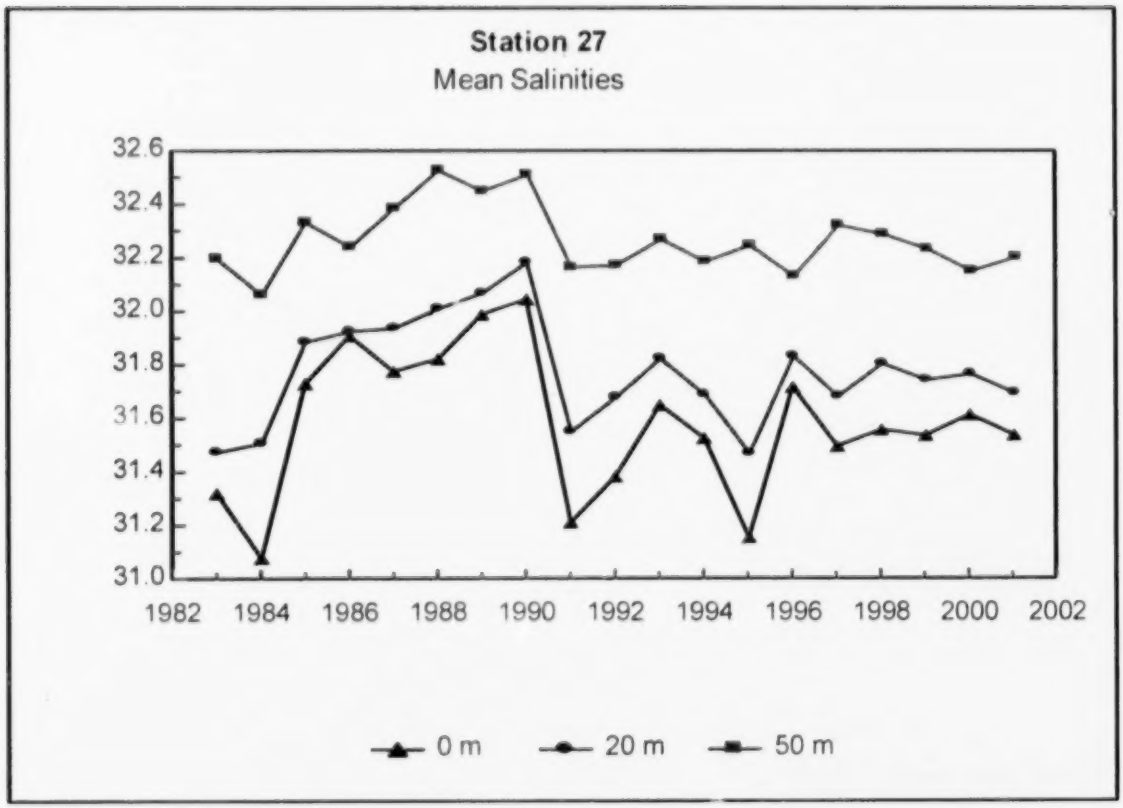

Figure 38. Mean salinities at 0, 20, and 50 m, from Station 27 (off St. John's), 1983 – 2001.

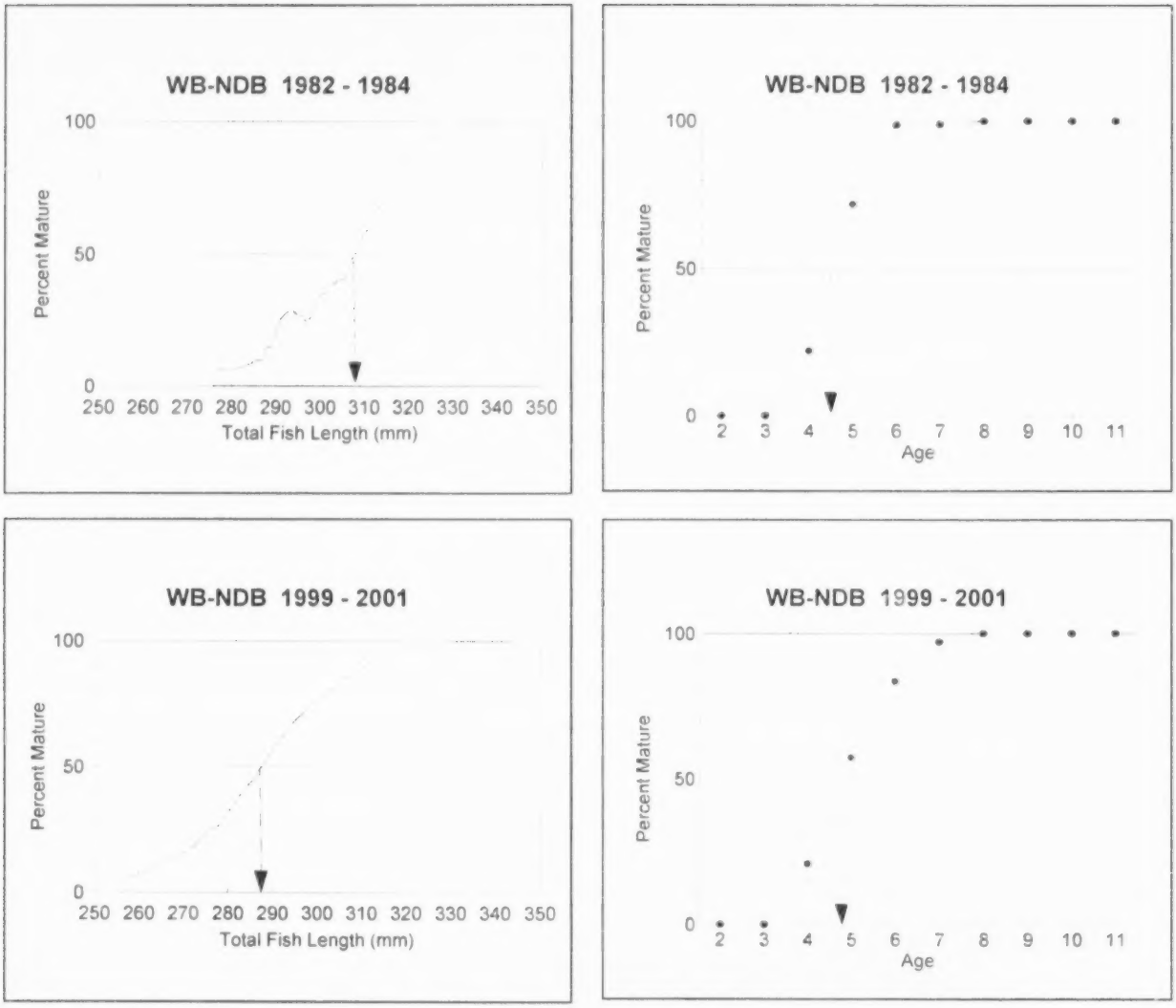

Figure 39. Comparison of length and age at maturity ogives for White Bay – Notre Dame Bay spring spawning herring for the periods 1982 – 1984 and 1999 – 2001.

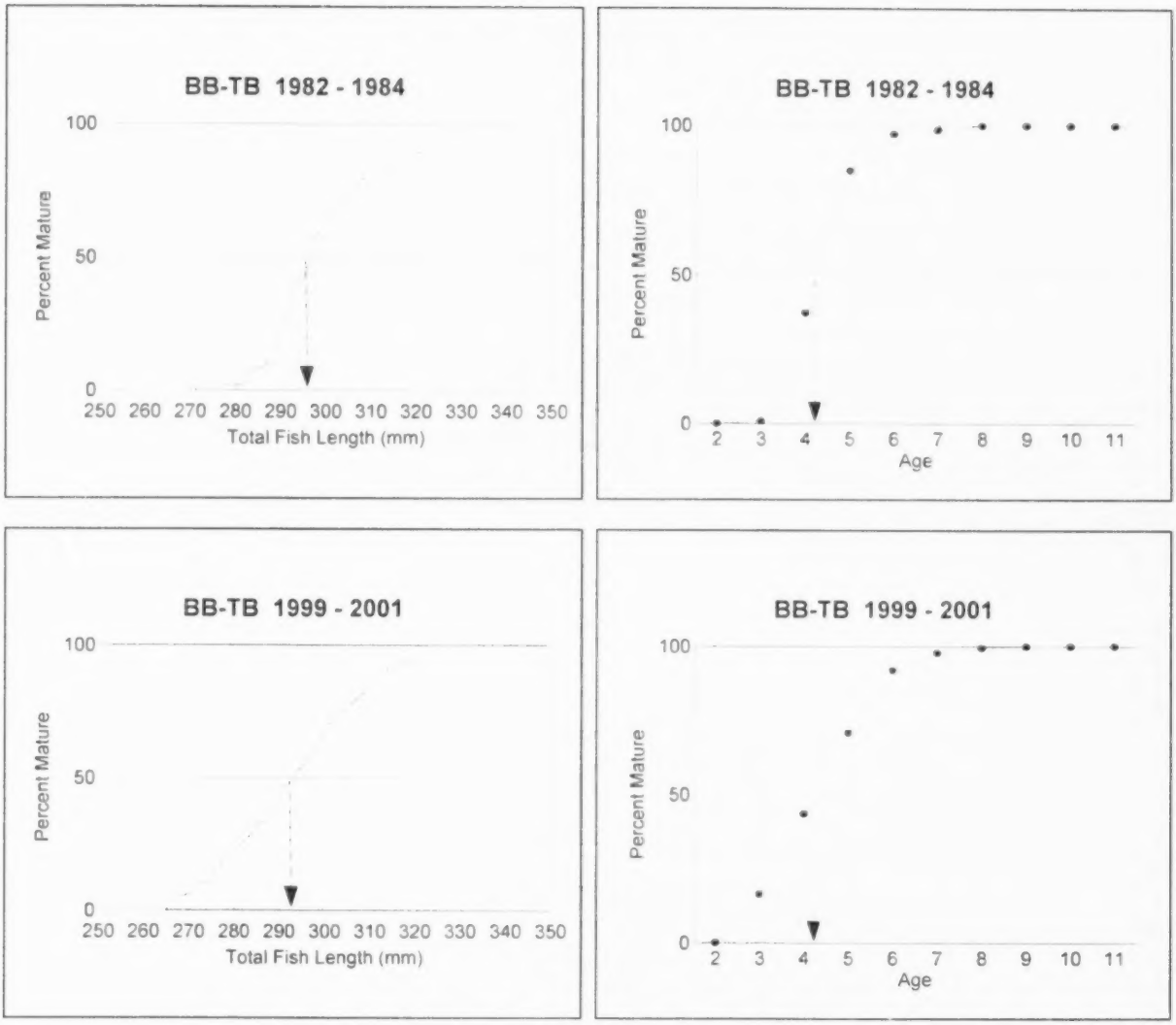

Figure 40. Comparison of length and age at maturity ogives for Bonavista Bay – Trinity Bay spring spawning herring for the periods 1982 – 1984 and 1999 – 2001.

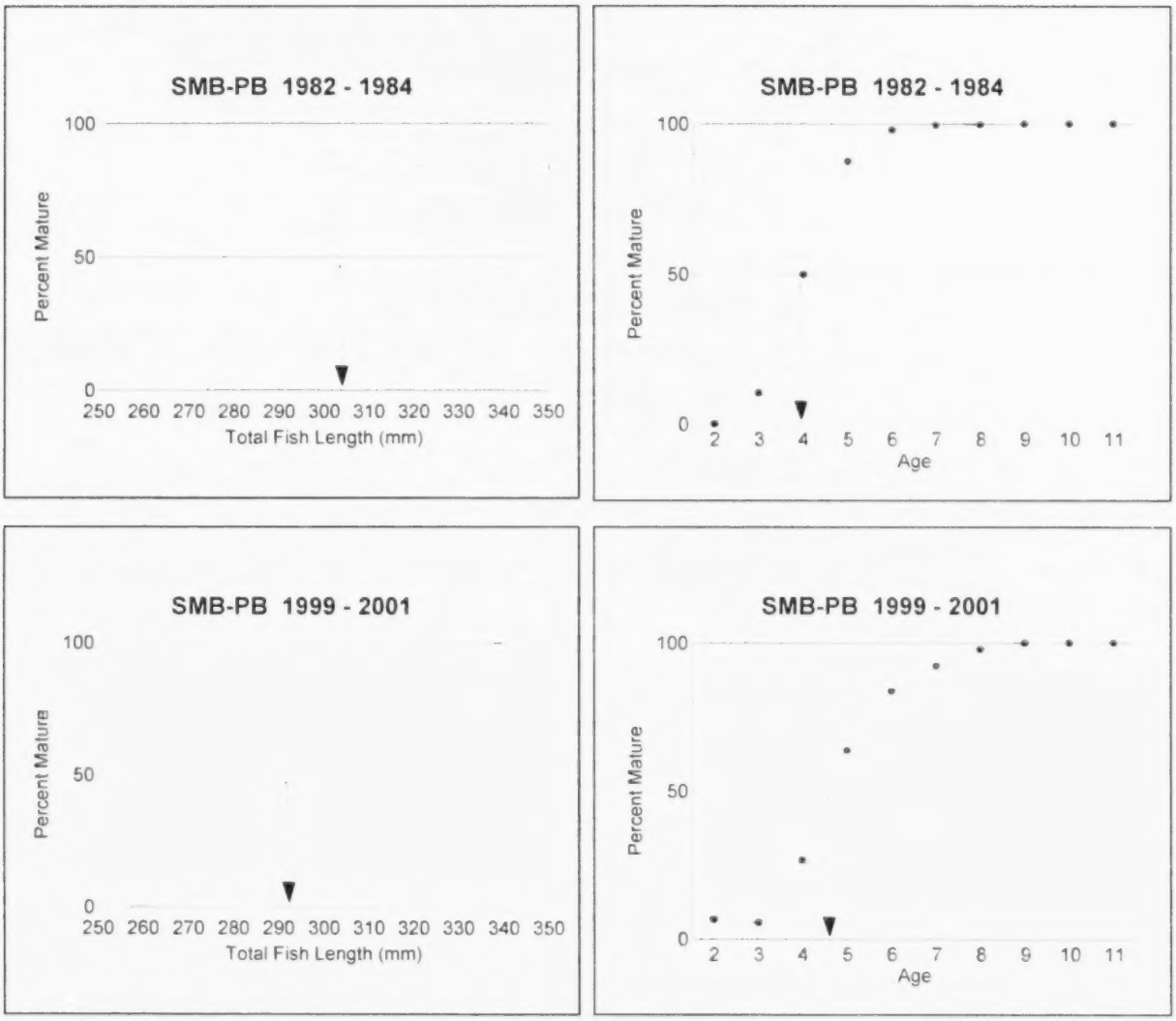

Figure 41. Comparison of length and age at maturity ogives for St. Mary's Bay – Placentia Bay spring spawning herring for the periods 1982 – 1984 and 1999 – 2001.

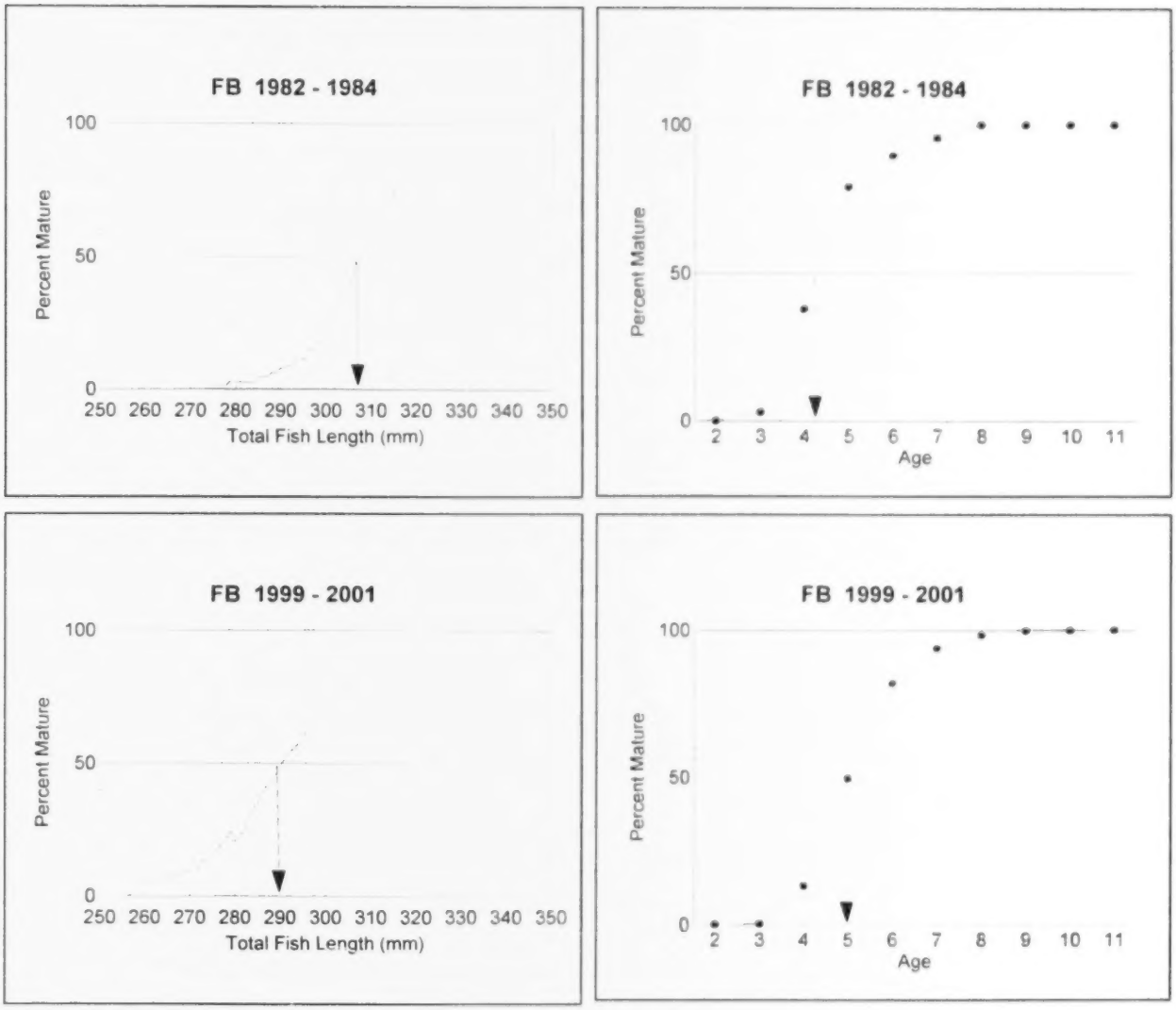

Figure 42. Comparison of length and age at maturity ogives for Fortune Bay spring spawning herring for the periods 1982 – 1984 and 1999 – 2001.

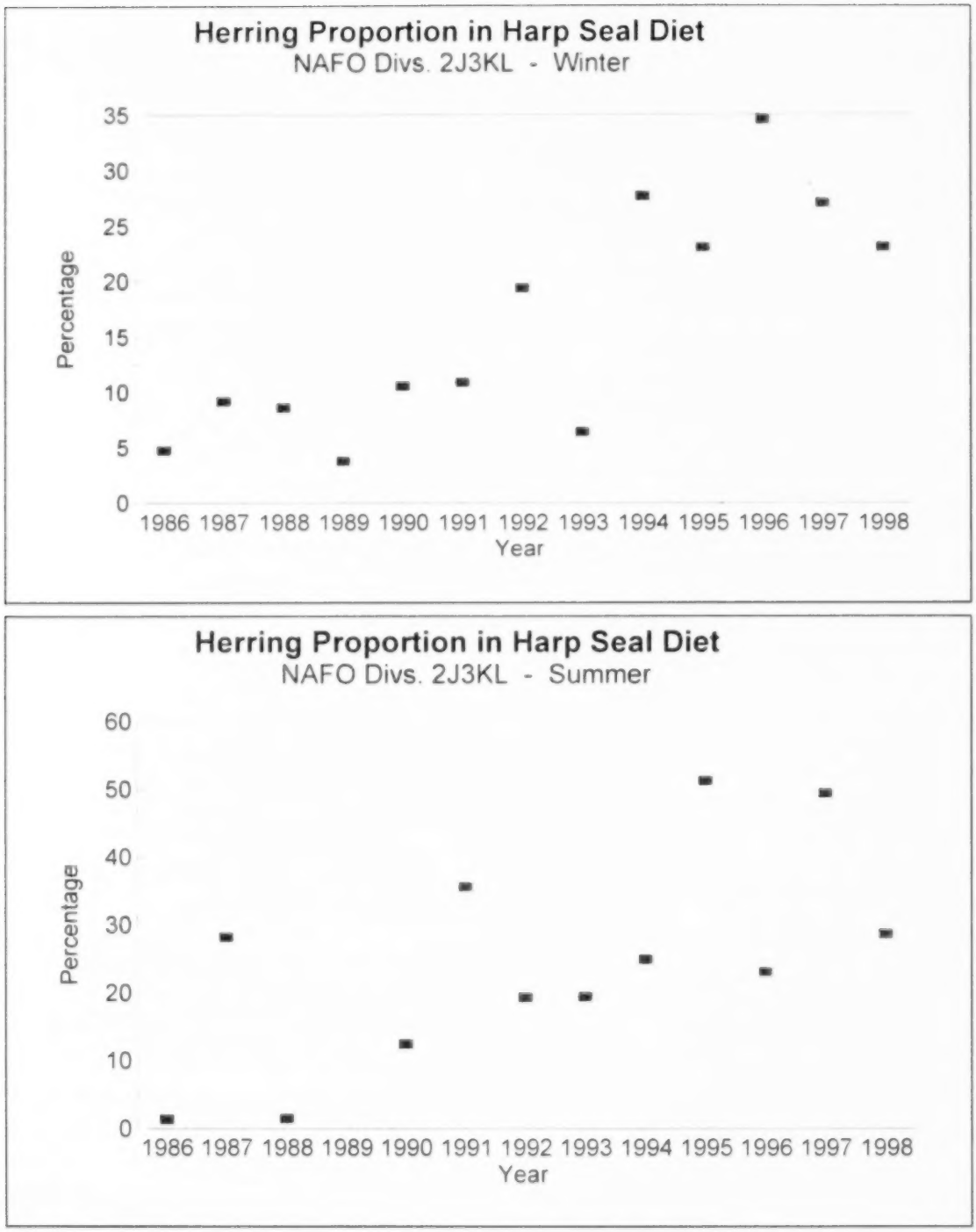

Figure 43. Proportion of herring in harp seal diet, winter and summer, in inshore areas of NAFO Div. 2J3KL, 1986 – 1998.

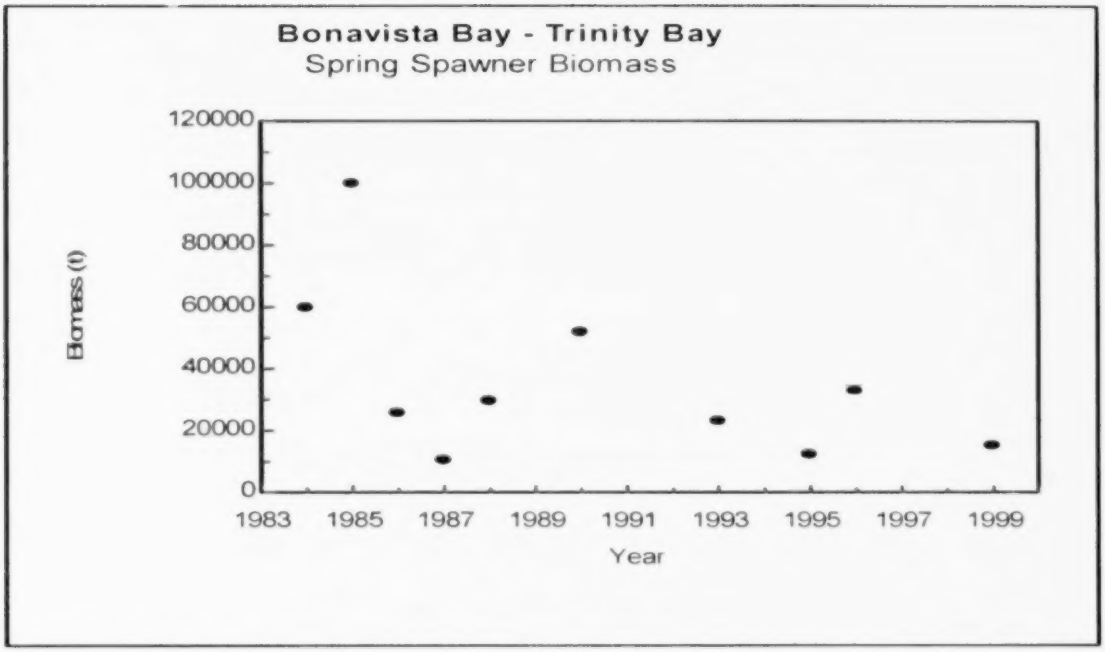

Figure 44. Comparison of acoustic biomass estimates for Bonavista Bay – Trinity Bay, 1984 – 1999.

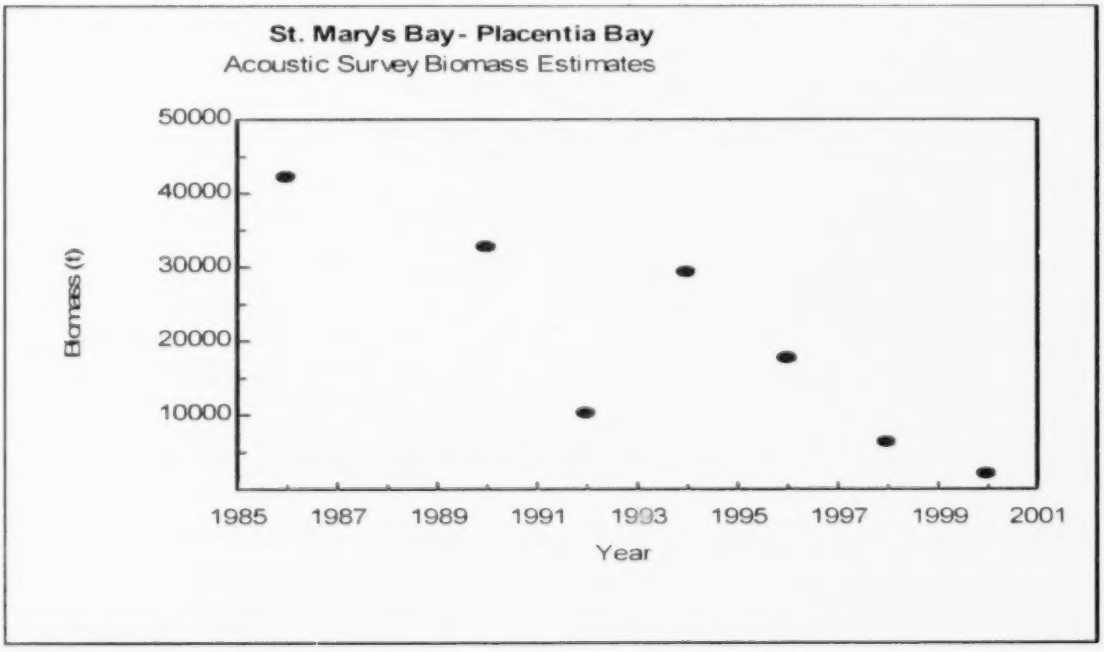

Figure 45. Comparison of acoustic biomass estimates for St. Mary's Bay – Placentia Bay, 1986 – 2000.